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Optimize Data Transfer for Microwave Connection in the Iraq Electrical Grid Communications Based Controlling Fuzzy-Estimation

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Abstract: ***The broadband in wireless services is very expensive, in sometimes limited and increase demand (for many serves). for this reason and other we need to manage the bandwidth by controlling the channels in communication system it's necessary that exploiting the good part form this bandwidth. In this paper, we propose to use estimation technique for estimate channel to transfer data thought channel as possible. the proposed estimation is based on the Minimum Mean Square Error (MMSE) and Modified Extended Kalman Filter (MEKF) this estimations technique used to find the Mean Final Error Ratio (MFER) in our propose. This error (MFER) uses as input to Fuzzy rule and then control parameter (control data, speech, image, video) for Microwave Connection for Iraq Electrical Grid, the Fuzzy adjusted availability channel with an amount of data needed to transfer over this channel at next time period The propose system is designed to management data communications through the channels connect among the Iraqi electrical grid stations. The results show that the modified Extended Kalman filter have a best result in time and noise estimation (0.1109 for 5% noise estimation to 0.3211 for 90% noise estimation and the packets loss rate is reduced with ratio from (35% to 385%).***

Keywords: error estimate channel, minimum mean square error (MMSE), Modified Extended Kalman Filter (MEKF), Mean Final Error Ratio (MFER)

1. Introduction

Electricity is one important issues in the word and especially in Iraq it comes second after the security after 2003. The power grid contains: [1] as shown in Fig.1the electrical grid in Iraq has

1) Energy production (generation power station) as a thermal's power station, gas turbine combined cycle power's station, hydro power's station, diesel power generation
2) Transmission: the networks transmission of Iraq contains (400kV, 132kV) substations system. Generations was connecting to the132kV or to 400kV systems. The transmission's system of the 400kV especially composed of single's circuit overhead lines' capacity of around 1,000 MVA. This system linked between them by overhead lines and underground power line cable.
3) Distribution' system consists of many substations such as (33/11kV, 11/0.4 kV) and overhead lines (33kV, 11kV, 0.4 kV) and underground's cables. [1]

The power grid stations contain a national control center linked RTUs, and renewing the PLC and Microwave communication's systems (400kV,132kV) transmission's systems and power energy generation. [1]

As being one of the most important factors to support development, the amount of electrical power demand increased rapidly. During the last six years [3] and there is an increase in demand for electric energy that mean we need to add a new units in the power station, transmission and Distribution system. [2], [4]

One part of the infrastructure in the power grid in Iraq is a control and communication. Control means work in the same unit as a (micro SCADA) but communication used to transfer data or information between units according the direction of linking these substations in the power grid. In this thesis we will focus in communications of transmission (substations 400k.v, 132k.v).

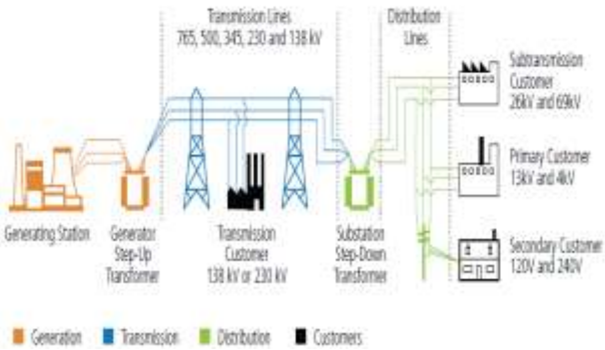

Figure 1: Electrical Grid [2].

2. Data Transfer in the Iraqi Electricity Grid Power

Data Transfer in The Iraqi Electricity Grid Power the data transfer in the electricity grid power in Iraq are used two ways (as shown in figure (2).

1. Power Line Carrier (PLC): it carries data over the wired of high voltage (400 KV, 132KV) (notes this voltage is in the Iraqi grid power but this may be different voltage from country to another as 750k.v, 138k.v…etc. in USA but all work as same technique) it carries only limited amount of data (64kbps) and recently used (256 kbps as ABB equipment) and this data rate is still very limited data rate compare another devices as a multiplexer.

2. Multiplexer (MUX): it is carrying data in many ways as a (cables،optical fibers, pilot wires, normal radio or point-to-point radio) [16]. This technique not use the electricity power wire (that carry power electricity and data over PLC in the same wire and same time) to carry data with the same wire carry the current power electricity, but send data and information split and send independents. The main structure of data transmission in electrical grid is Microwave channels with maximum bitrate 2Mbit/sec, as shown in figure (2) type of transfer data in the Electrical Grid.

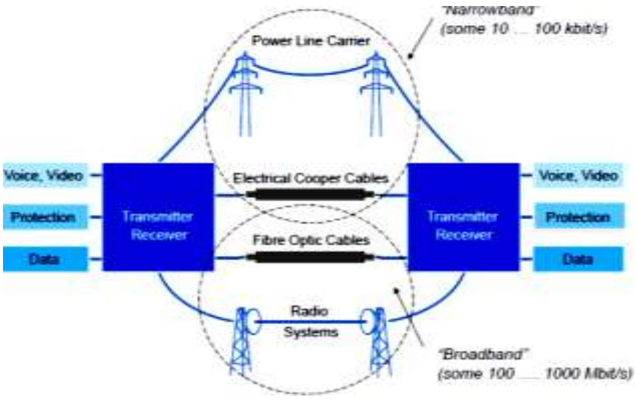

Figure 2: Example of the data transmission in the Electrical Grid

More applications of distributing multimedia were became an integrated with computing and communication's environments. For achieving this goal, multimedia applications should be delivering high QoS. This is represented a challenges when distributed multimedia applications were executed on general purposes operating's systems and network that was developing to process best-efforts data and transmission. Therefore, they bear high level of troubles in resource allocation when treating continuous media. For solving this challenge, many techniques for QoS adaptations for distributing multimedia system situation are proposed [10].

The network problem congestions controls stay as critical high priority and issues, principally when increase the demands in using the Internet during delay-time sensitives application with different Qualities of Services (QoSs) requirements' [7].

Many researches effort a large numbers of difference proposed controls systems. But still no universal acceptable congestions controls solution. Even with techniques of the classical-controls systems proposed in different researches, still don't perform sufficient controlling of the dynamic, and the non-linearities network or in Internet [7].

For many years, fuzzy logic control (FLC) is well known Computation Intelligences techniques in the best applications are used in many control researches especially in the networks and communication [7].

In this section, we explain and discuss some of the control system used the estimation operation in controlling the network Qualities of Services QoS, and the researches used in their suggestion the fuzzy control system techniques:

M. Reda and et al (2006) [1], they review and explain the Iraqi-electrical-power systems history and illustrate the methods to enhancement and improved the infrastructures. The electrical-network due to the military operations, substantial damages, and poor maintenances with a very little developments and assessment replacements, that all results in reduction qualities operations and communications. They proposed some solution in the ongoing repairing infrastructure of the gird and stations and connect them with intelligent modern communication system of the Iraqi electricity grid system.

Feng Xia and et al (2007) [6] developed a fuzzy-logic controls based on QoS managements technique for Wireless network (WN) with forced resource and un-predictable environment. Take advantages of the feedbacks controls technology, this technique deal with the impacts of un-predictable change in network traffic loading on the QoS. It profits a fuzzy-logic controllers (FLCs) in each sources node to adaptive the sample periods to the dead-line miss-ratio associate with data transfer from the part to the other in WSN. The dead-line miss-ratio is maintaining at a predetermined desire levels so that the requires QoS can be achieved. The Fuzzy control has the advantages like scalability, generality, and simplicity. Qiu Gongan and et al (2007) [8], admission-controls are a useful functions for multiservice of IP networks. They proposed a novel fuzzy-admission controls technique based on poor granularities service aware techniques. Various services have discriminative sensitivities to the same QoS characteristics parameters. The network traffics classes can be perceived by the services requested parameters and the proposes QoS functions. The various application requirements can metting by maintain the parameter lifecycle. They get better QoS provisions than the traditional fuzzy-logic under the samilar admission probabilities in the simulation environment. Muhammad Mostafa Monowar and et al (2008)[9], explained the Wireless Sensor Network (WSN) can ingest different real-time multimedia-applications that should meeting several requirements of the QoS (e.g. delays, jitters, throughputs, packets loss) under strict resources restrictions. Hence, the (QoS) managements in WSNs are important issues so to investigate. Because the highest data rates and bursts network traffics for real-time applications, congestion occurrences are very popular happen. The QoS requirement ensuring under congest scenarios are quite challenges. They proposes a hop by hop dynamics ratio controlling technique that control the congestions as well as ensure that the real-time traffics will meeting the soft-QoS requirement. They illustrated per hop dead-line missing ratio as the congestions marker metrics and perform the rates controlling when rate go higher the certainty levels. So, by using per hop adjusting rates, soft-QoS will meting the local that turned meet (the end to end) soft-QoS. The simulation results show the effectiveness and abilities of the proposes. Rosa Maria Alsina Pagès and et al (2007) [11], proposed multi-resolutive acquisitions technique based on the fuzzy-logic estimators. The most one important ting problem is to solving Direct-Sequence Spread-Spectrum system by achieving perfect acquisitions for the pseudo-noise sequences. In time varying environment, acquisition and tracking performances be very important, due to the heavily degrading in the connection reliabilities. The fuzzy-logic estimator will improve the acquisition accuracy comparing with the stability controller results, during the probability estimation of the signal- noise- ratios for the channels. Luci Pirmez and et al (2007) [12]. proposed a fuzzy based decision making technique for choosing data transfer protocol in wireless network. The fuzzy choosing the efficient protocols in order to increase the network performances and application specific requirement. The technique used to control under the simulation. Firstly, well known network protocol is simulate using different-scenarios and applications requirement to send results to the knowledge-base. Then, fuzzy system is build base on the simulation result with developed guiding knowledge base building methodology.

In this paper we suggest the fuzzy rules as automatic control with many channel error (noise) estimations to control the data transferring in the Microwave channels connected the power stations in the Iraqi electrical grid.

3. Channel Estimation Techniques

There are two estimating methods for the parameters of the channel at each subcarrier:

1) Techniques to estimate the Blind channels.
2) Techniques to estimate Pilot assist channels: that was using in the MMSE, LS, and LMS Algorithms [21], [23] and other methods for Channel estimation problems based in semi-blind approach are used. [17], [18].

3.1 Minimum Mean Squares Estimators (MMSE)

MMSE estimator method searches the function F, where $F$and H in relate with each other such that $\boldsymbol{H}$ is on average near to the true channel probe $\boldsymbol{H}$ as possible.

$$\hat{H} = F(Y) \qquad \text{……... (1)}$$

In other hands, the goal is to minimize the mean square error of H for a given realization of Y. Equation (2.6) represents the mean square error and the argument to minimize it as follows:

$$EH, [\| H - \hat{H} \| 2] \qquad \text{……. (2)}$$

The main advantage of the MMSE is that it tries to find the best tradeoff between the variance of the estimator and the assistance of the mean squared norm of bias based on the fact that it utilizes the channel knowledge and covariance matrices of the noise [19], [20]. [22].

3.2 Extended Kalman Filter Estimator

There are two types of time spaces discrete and continuous that used for representing the models of any system some on continuous and other on discrete [13], [14], and [24].

The estimation state measurements were taking from discrete time for a digital processor. Here, the model and measurement of the system model as follows:

$$\dot{X}(t) = F(t)X(t) + B(t)u(t) + w(t) \text{ ...(3)}$$

$$w(t) \sim N\big(0, Q(t)\big)$$

$$z_k = H_k x_k + v_k, \qquad \text{....(4)}$$

$$v_k \sim N(0, R_k)$$

Where $\quad x_k = x_{(tk)}$

Initialize $\quad \hat{x}_{0|0} = E[X(t_0)], p_{0|0} = Var[x(t_0)]$

Predict

$$\dot{\hat{x}}(t) = F(t)\hat{x}(t) + B(t)u(t), with\, \hat{x}(t_{k-1}) = \hat{x}_{k-1|k-1}$$

$$\Longrightarrow \hat{x}_{k|k-1} = \hat{x}(t_k)$$

$$\dot{P}(t) = F(t)X(t) + P(t)F(t)^T + Q(t), with\, P(t_{k-1}) = P_{k-1|k+1}$$

$$\Longrightarrow P_{k|k+1} = P(t_k)$$

The derived estimation equations were taken from those of Kalman's filter in continuous-time with no updated measurements, i.e., K (t) =0. The system can calculate the covariance and estimated state by solving some differential's equations with estimated value as an initial condition from the above step.

$$X_k = a(x_{k-1}, (W_{k-1}) \quad \text{...(5)}$$

$$Z_k = h(x_k, (v_k) \quad \text{....(6)}$$

(EKF)An Extended Kalman filter was basically a Kalman filter that modifying for linearizing the estimation of covariance and the current mean. Same to equations of the MKF, the MEKF can be expressing as:

For Predict, the proposed modified equations are:

$$\hat{x}_{\bar{k}} = a(\hat{x}_{k-1}\, 0)$$

$$P_{\bar{k}} = A_k P_{k-1} A_k^T + (W_K^T Q_k (W_k)$$

For correction and updating, the proposed modified equations are:

$$K_k = P_{\bar{k}}^{-} H_K^T (H_k P_{\bar{k}}^{-} H_k^T + v_k v_k^T (R_{k-1})^{-1} \text{ ... (7)}$$

$$\hat{x}_k = \hat{x}_{\bar{k}} + \mathrm{K}_k (Z_k - h\hat{x}_{\bar{k}}) \text{ ...(8)}$$

$$P_k = (I * R_k - \mathrm{K}_K H_k)\, P_{\bar{k}} \text{ ... (9)}$$

Recalculate:

$$K_k = P_{k|k-1} H_k^T (H_k P_{k|k-1} H_k^T + R_k)^{-1} \text{ … (10)}$$

$$\hat{x}_{k|k} = \hat{x}_{k|k-1} + K_K (z_k - H_k \hat{x}_{k|k-1}) \text{ … (11)}$$

$$P_{k|k} = (I - K_k H_k) P_{k|k-1} \text{ …. (12)}$$

The new equations are conformable to the equations in the Extended Kalman's filter in discrete-time.

4. The Proposed System

Many distributed multi-media were become an integral parts of the network environment. In order to get this target, the multimedia files should deliver with highest Quality of Services (QoS). The challenges in the multimedia distribution are networks errors and noise in the data traffic, also data transmission mechanism between power station of the electrical grid. In the power grid in Iraq, either PLC (power line carrier) used to send data over the lines power phase and the multiplexer (MUX with pilot cable, microwave, and fiber optic) also used to send data separately from the transmission power lines with some problems in the network QoS.

The main goal of the proposed system is to improvement the data transfer in the wireless network connected the power stations in Iraqi Electrical Grid. The improvement operation cab done by use the intelligent technique to solve many problems described above by optimization data transfer over the electricity grid. The selection of the Microwave channel due to the limitation of PLC (power line carrier), and because the grid power have many substation uses Microwave network (with 2Mbps bit rate) behind the old (PLC) that has limited capacity channel (64 kbps). In this research, we proposed the Fuzzy Logic control rules used for adaptive the Microwave network QoS in order to distributed multi-media (like data parameters, speech phone calls, images, and web camera videos) and control the transmission in Iraq power grid to improvement the data transmission operation. This goal can be done through calculate the error rate (caused by noises) and estimate the next error rate in the network channel. Depending on the error rates, the best fuzzy rules can apply to take adjust the compression techniques with compression ratio and the number of the multimedia can be send as sub channels transfer (and number of delayed multimedia stored in delayed buffers).

In this s proposed system, the error estimation stage checks the current error rate (like noise ratio) and estimate the error rate in the next period by using four different techniques (Modified Extended Kalman Filter MEKF, Minimum Mean Square Error (MMSE), By using the automatic packet generation technique to generated and send testing packets to all active nodes in the network. Estimation vector will be used in the proposed Fuzzy controls communication stage. Many compression techniques were used like (Lossless and lousy) JPEG image compression, Pulse Code Modulation PCM for speech compression, and H.264/AVC for web camera videos. There are different compression and qualities degrees are used depending on the decision of the proposed Fuzzy control stage. The proposed system was designed to be fasting in the implementation by use the modern algorithms and reduction these algorithms as possible. Figure 3 shows the flowchart of the proposed system.

The proposed system can divide into four stages:

Network stage: in this stage the network parameters, nodes number, sending and receiving test packets are illustrated.

Error Estimator Stage: the error calculated and estimated for the next time periods using the Modified Extended kalman filter, Extended Kalman filter, and MMSE estimators.

Fuzzy Control Stage: The outputs of the estimators are input to the Fuzzy rule control to adjust the priorities and compression ratio and types.

Send Media Stage: in this stage, the media sending after applying the fuzzy control rules on the buffered media like speech, web camera video, images, and controlling power station parameters through the sub channels. The sending operation is based on the TCP/IP protocol.

In this stage, The Modified Extended Kalman filter (MEKF) extended by nonlinear stochastic operation. The processes to be estimate or measurements process's relations are nonlinear predominating. This is of course true when the dynamics states of the channel state were estimated. A nonlinear system can be modeled using nonlinear randomly processes and measurement's equations conformable to linear equation (1) and equation (2):

$$X_k = a(x_{k-1},(W_{k-1}+MPNR)/2) \ldots.(13)$$

$$Z_k = h(x_k,(v_k+MPNR)/2) \qquad \ldots\ldots\ldots(14)$$

(EKF)An Extended Kalman filter was basically a Kalman filter that modifying for linearizing the estimation of covariance and the current mean. Same to equations of the MKF, the MEKF can be expressing as:

For Predict, the proposed modified equations are:

$$\hat{x}_{\bar{k}} = a(\hat{x}_{k-1}\ 0) \ \ldots\ldots.(15)$$

$$P_{\bar{k}} = A_k P_{k-1} A_k^T + (W_K^T Q_k (2 * W_k + MPNR)/3).(16)$$

For correction and updating, the proposed modified equations are:

$$K_k = P_{\bar{k}} H_K^T (H_k P_{\bar{k}} H_k^T + v_k v_k^T (2R_k + R_{k-1})/3)^{-1}.(17)$$

$$\hat{x}_k = \hat{x}_{\bar{k}} + \mathrm{K}_k (Z_k - h(\hat{x}_{\bar{k}}, MPNR/2)) \ldots\ldots.(18)$$

$$P_k = (I * R_k - \mathrm{K}_K H_k\ ) P_{\bar{k}} \ \ldots\ldots(19)$$

Suppose that the matrices of covariance of the process noise Q and the covariance measurement noise R are constant at the same time interval.

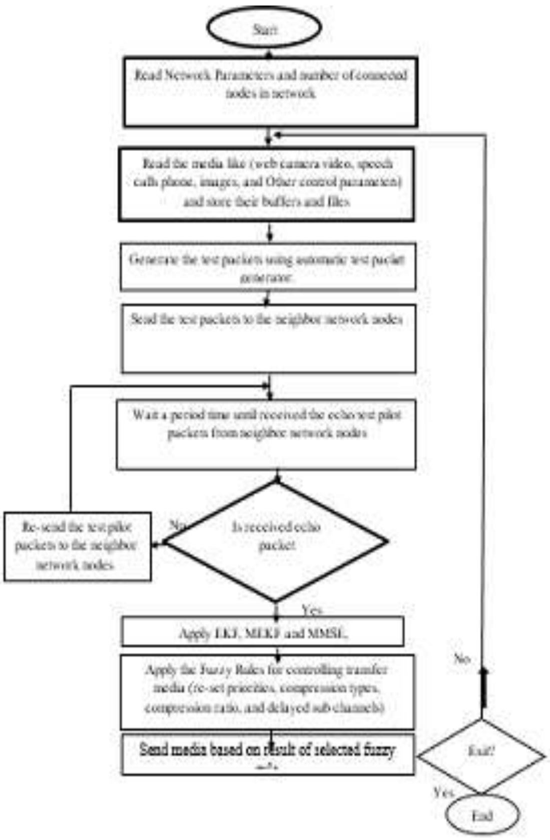

Figure 3: The Flowchart of the proposed system

The mechanism of MEKF (Modified Extended Kalman Filter) Algorithm explained as shown in figure (3). In order to understand the common MEKF better. There are three main calculating according to the four main equations that need to be done frequently. First one in calculating the Modified Kalman Gain (MEKG) to make the estimate zooming into the actual correct value, and we needed to calculate each times this MEKG. Then its need to calculate the current estimate each time are going to update the estimate. Finally, it is important to re-calculate the new error (the uncertainty) in the estimate. From the figure, it is clear that it is need two things knows for calculate the MEKG, first one is the error in the estimation (the mean previous error or the original error), and later is the error in the data input, both of these feed into the calculation come up. Secondly, the MEKG feeds into the calculation of the current estimate depending upon what the gain is the adjustment to the mean previous estimate that come up with a new estimate of the gain, beside of the gain it is depending upon the mean and previous estimate and with the next iteration the new data comes in. Then it has been used to re-calculate the new estimate, so that it is always feedback in on itself that mean it is need the mean previous estimated that calculated before but if it is the first times it need to takes the original estimate. Finally, when the calculation in one and two has been done, then calculation for the error estimation can be achieved for the next time around.

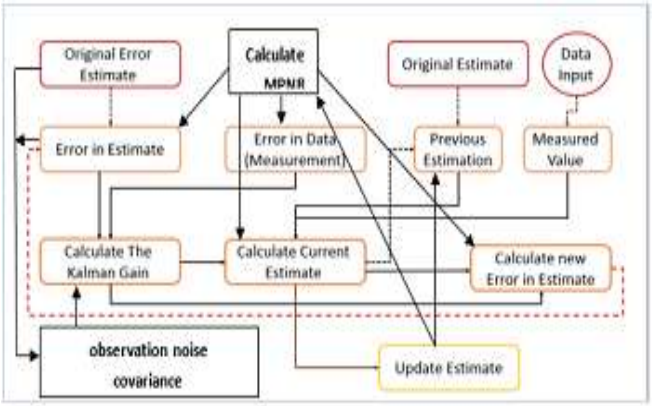

Figure 4: Block diagram of The Proposed Modified Extended Kalman Filter for Estimation.

5. The Fuzzy Control Stage

Fuzzy Control Stage contain the main operation of the controlling the sequence of the transfer media. The outputs of the error estimation stage is a Error Estimation Ratios (EER) Vector passed as input to the Fuzzy rule control stage to adjusted the priorities, compression ratio, compression types, and Sequence of the media.Also the Mean Perivious Noise Ratios (MPNR) will compute from the pervios noise or error estimated for the channel during the work duration.

The average of EER vector(without Mean Perivious Noise Ratios MPNR) will used as the final error estimation value called Mean Final Error ratio (MFER) and compare it with the MPNR, if the MPNR greater than with high difference, then MFER as estimate ratio, if the MPNR close or near the MFER then MFER= (MFER+ MPNR)/2. From this ratio, the proposed system selects the appropriate fuzzy rule to control the sending operation.

The proposed Fuzzy rules are as following(where no. of media in buffers(MB), Initial no. of subchannels (IS), and Compression ratio CR):

Base 1: If (MFER≤5% of the channel capacity) and (MB≤IS) then No compression, CR=0, no change the priority and sequence of media in transmission buffers, no delay.

Base 2: If (MFER≤5% of the channel capacity) and (MB>IS) then Lossless compression, CR=10%, change the priority and sequence of media in transmission buffers. (speech, Parameters, control data, images, and the less priority videos), no delay needed in videos subchannels.

Base 3: If (%5<MFER≤15% from the channel capacity) and (MB≤IS) then Lossless compression, CR=15%, no change the priority and sequence of media in transmission buffers.

Base 4: If (%5<MFER≤15% from the channel capacity) and (MB>IS) then Lossless compression, CR=15%, change the priority and sequence of media in transmission buffers (speech, Parameters, control data, images, and the less priority videos), no delay needed in videos subchannels.

Base 5: If (%10<MFER≤25% from the channel capacity) and (MB≤IS) then Lossy compression, CR=15%, change the priority and sequence of media in transmission buffers (speech, Parameters(control data), images, and the less priority videos), and need to delay in last two videos subchannel.

Base 6: If (%10<MFER≤25% from the channel capacity) and (MB>IS) then Lossy compression, CR=25%, change the priority and sequence of media in transmission (speech, Parameters(control data), images, and the less priority videos), and need to delay in last three videos subchannel.

Base 7: If (%20<MFER≤35% from the channel capacity) and (MB≤IS) then Lossy compression, CR=40%, change the priority and sequence of media in transmission buffers (speech, Parameters (control data), images, and the less priority videos), and need to delay in last three videos subchannel.

Base 8: If (%20<MFER≤35% from the channel capacity) and (MB>IS) then Lossy compression, CR=50%, change the priority and sequence of media in transmission buffers (speech, Parameters(control data) , images, and the less priority videos), and need to delay in last five videos subchannel.

Base 9: If (%30<MFER≤45% from the channel capacity) and (MB≤IS) then Lossy compression, CR=50%, change the priority and sequence of media in transmission buffers (speech, Parameters(control data) , images, and the less priority videos), and need to delay in last four videos subchannel.

Base 10: If (%30<MFER≤45% from the channel capacity) and (MB>IS) then Lossy compression, CR=60%, change the priority and sequence of media in transmission buffers (speech, Parameters(control data), images, and the less priority videos), and need to delay in last six videos subchannel.

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Base 11: If (%40<MFER≤60% from the channel capacity) and (MB≤IS) then Lossy compression, CR=70%, change the priority and sequence of media in transmission buffers (speech, Parameters(control data), images, and the less priority videos), and need to delay in last seven videos subchannel.

Base 12: If (%40<MFER≤60% from the channel capacity) and (MB>IS) then Lossy compression, CR=75%, change the priority and sequence of media in transmission buffers (speech, Parameters(control data), images, and the less priority videos), and need to delay in last eight videos subchannel.

Base 13: If (%55<MFER≤65% from the channel capacity) and (MB≤IS) then Lossy compression, CR=75%, change the priority and sequence of media in transmission buffers (speech, Parameters(control data), images, and the no videos), and need to delay in last three speech and seven images subchannel.

Base 14: If (%55<MFER≤65% from the channel capacity) and (MB>IS) then Lossy compression, CR=75%, change the priority and sequence of media in transmission buffers (speech, Parameters (control data), and no images and videos), and need to delay in last four speech subchannel.

Base 15: If (%60<MFER≤85% from the channel capacity) and (MB≤IS) then Lossy compression, CR=75%, change the priority and sequence of media in transmission buffers (speech, Parameters(control data), and the no images videos), and need to delay in last seven speech subchannel.

Base 16: If (%60<MFER≤85% of the channel capacity) and (MB>IS) then Lossy compression, CR=75%, change the priority and sequence of media in transmission buffers (speech, Parameters (control data), and no images and videos), and need to delay in last eight speech videos subchannel.

Base 17: If (MFER>85% of the channel capacity) then the channel very noisy and no valid to transfer data.

Base 18: Up data the noise level comparison values for the Bases rule (1-17) depend on weather conditions, distance between power stations, day time hours, day night, and conditions parameter from user.

As above shown , the fuzzy rules proposed to uses in this stage covere the noise ratio from the 5% to 85%, and choose the base rule and their actions depend on these MFER(mean final error raito). The priority is very important here to make the re-sequence the media in the transfer buffer (over channel) more effective in sending the important data then others data not important . The compression type and ratio help to avoid the noises interference by reduced the size of data with keeping the most details as possible as a(control data). The reduction of data transfer in the channel useful in reduction the noise infection and sending time. The error ratio (noise) can be change during year (as a weather) and locations of the power stations.

The results from the implementation proposed system in the simulatiom eniroments were show the improvement in the increasing number of sending media (subchannels) by at least 3 times, and reduction (with 30-90%) in the losing packet through connection operation for all different error ratios. Time of the all operations in the proposed system was acceptal and can be consider fasting with average (1-3) second. Also, the modified Extended Kalman Filter estimator has best results of error estimation from the other used estiomators.Also, the modified Extended Kalman filter are more speed from minimum mean square error (MMSE). Figures (5)shows the results of the proposed system.

Figure 5: The Results of the Sending-Receiving Test Packets

figure (6) shows the results of error estimation by Modified Extended Kalman filter(MEKF) (blue line) for different types of noise through the time is near to the actual error rate, while the Extended Kalman Filter (EKF) (Violet line) has some different from the actual error rate measured.

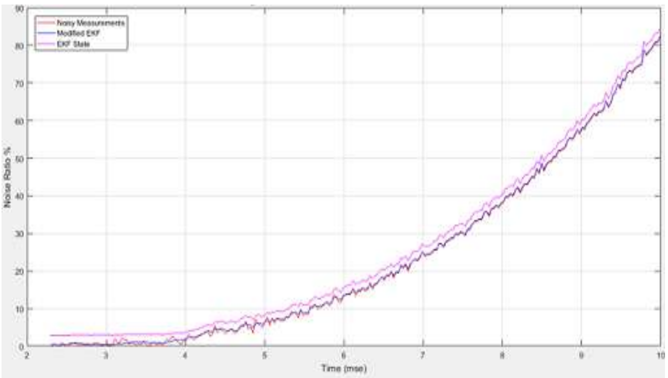

Figure 6: Modified Extended Kalman and Extended Kalman Filter Results

From above figure, The MEKF is close to the actual noise ratio in many ratios while the EKF is some away different from the actual during the time of estimation. That clear in Table 1: shows the results of the two estimators MEKF and EKF.

Table 1: MEKF, EKF Estimator Results and Time

Actual noise ratio	*MEKF estimation*	*Time ($_{MEKF}$) sec*	*EKF estimation*	*Time ($_{EKF}$) sec*
5%	5.029%	0.1730	5.102%	0.1871
10%	9.998%	0.1789	11.301%	0.1875
15%	14.987%	0.1792	17.645%	0.1880
25%	25.001%	0.1801	26.214%	0.1882
35%	35.100%	0.2122	36.637%	0.1898
45%	45.216%	0.2187	46.759%	0.1997
60%	60.910%	0.2192	62.132%	0.2010
65%	66.010%	0.2234	66.183%	0.2110

75%	75.999%	0.2250	77.689%	0.2190
85%	86.198%	0.2267	87.217%	0.2210
90%	91.011%	0.2270	92.450%	0.2215

The MEKF is in some state been closer to the MMSE as shows in figure (7).

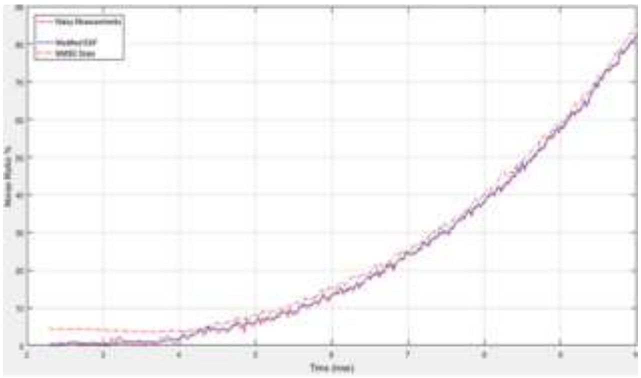

Figure 7: The MMSE and MEKF results

Table 2: shows the MEK and MMSE Estimation results and Time

Actual noise ratio	*MEKF estimation*	*Time ($_{MEKF}$) sec*	*MMSE estimation*	*Time ($_{EKF}$) sec*
5%	5.029%	0.1730	5.078%	0.2351
10%	9.998%	0.1789	10.120%	0.2562
15%	14.987%	0.1792	15.210%	0.2711
25%	25.001%	0.1801	25.325%	0.2963
35%	35.100%	0.2122	35.700%	0.3012
45%	45.216%	0.2187	46.163%	0.3107
60%	60.910%	0.2192	62.120%	0.3218
65%	66.010%	0.2234	66.980%	0.3300
75%	75.999%	0.2250	77.159%	0.3341
85%	86.198%	0.2267	87.256%	0.3368
90%	91.011%	0.2270	92.123%	0.3390

As shows in table 2 the resule of MEKF is best from MMSE but MMSE is best than EKF that can shows in table 3.

Table 3: shows the EKF and MMSE Estimation results and Time

Actual noise ratio	*EKF estimation*	*Time ($_{MEKF}$) sec*	*MMSE estimation*	*Time ($_{EKF}$) sec*
5%	5.102%	0.1871	5.078%	0.2351
10%	11.301%	0.1875	10.120%	0.2562
15%	17.645%	0.1880	15.210%	0.2711
25%	26.214%	0.1882	25.325%	0.2963
35%	36.637%	0.1898	35.700%	0.3012
45%	46.759%	0.1997	46.163%	0.3107
60%	62.132%	0.2010	62.120%	0.3218
65%	66.183%	0.2110	66.980%	0.3300
75%	77.689%	0.2190	77.159%	0.3341
85%	87.217%	0.2210	87.256%	0.3368
90%	92.450%	0.2215	92.123%	0.3390

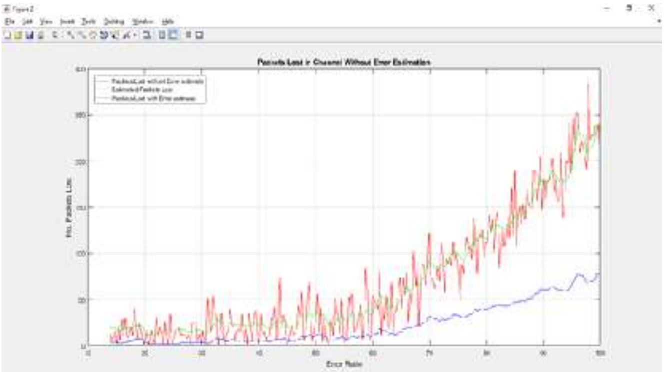

Figure 8: The Comparison Results of testing the network using test packets

As shown in figure (8), the packets loss rate is reduced with ratio from (35% to 385%) after using the proposed system.

6. Conclusions

In this paper, the error estimation filters were used to check the current error rate in channel communications for the Iraqi Electrical Grid system (likes noise ratio) and to estimates the error rate for the next periods by using the combination of the three different techniques (MEKF, EKF, MMSE) for the Microwave channel.

Fuzzy base rules are used to selects the transformation conditions and parameters for the current environment and estimations noise rates. As shown from the above results, the error(noise) estimation output level have improved and adjusts the data transfer in the noisy channel by help in selection the no. of sub channels, compression ratio, compression type, and the specific delay transfer time for the lowest priority media sub channels passed to the Microwave channel of Iraqi Electrical Grid. The proposed system implements in the simulation environment to test its operation and techniques and got the packets loss rate with (35% to 385%) depended on the noise ratio levels.

References

[1] M. Reda, N. Saied, A. Khaldi, M.A.Abdul-Hussain, and A. Ekwue," Iraq Electrical Power Infrastructure – Past, Present and Future Developments and Expectations", Power Systems Conference and Exposition, PSCE '06. 2006 IEEE PES, 2006.

[2] Saif Rashid, Irene Peters, Martin Wickel, and Christoph Magazowski "Electricity Problem in Iraq", Economics and Planning of Technical Urban Infrastructure Systems, March 18 2012.

[3] Impact of UPFC-based damping controller on dynamic stability of Iraqi power network Lokman H. Hassan1*, M. Moghavvemi1 and Haider A. F. Mohamed2 1Centre for Research in Applied Electronics (CRAE), University of Malaya, 50603 Kuala Lumpur, Malaysia.2Department of Electrical and Electronic Engineering, University of Nottingham Malaysia Campus, 43500 Semenyih, Selangorr, Malaysia. Accepted 25 November, 2010

[4] Mohammed Hammed Yasen ,"Analyse the Problems of the Iraqi Power System", Advances in Energy

Engineering, Volume 4, 2016 , doi: 10.14355/aee.2016.04.003.

[5] Pirmez L., Delicato F.C., Pires P.F., Mostardinha A.L., de Rezende N.S.," Applying fuzzy logic for decision-making on Wireless Sensor Networks", IEEE International Symposium on Fuzzy Systems Conference, pp. 1–6 (2007).

[6] Feng Xia, Wenhong Zhao, Youxian Sun, and Yu-Chu Tian1," Fuzzy Logic Control Based QoS Management in Wireless Sensor/Actuator Networks ", Sensors (Basel). 2007 Dec; 7(12): 3179–3191 PMCID: PMC3841889.

[7] Chrysostomos Chrysostomou and Andreas Pitsillides, "Fuzzy Logic Control in Communication Networks ", Hassanien AE., Abraham A., Herrera F. (eds) Foundations of Computational Intelligence Volume 2. Studies in Computational Intelligence, vol 202. Springer, Berlin, Heidelberg.ISBN: 978-3-642-01532-8.

[8] Qiu Gongan , Zhang Shunyi , and Liu Shidong , " Service-aware based fuzzy admission control scheme in multi-service networks", Journal of Electronics (China) July 2007, Volume 24, Issue 4, pp 537–543, Science Press.

[9] Muhammad Mostafa Monowar, Md. Obaidur Rahman, Byung Goo Choi, and Choong Seon Hong, "A Hop by Hop Rate Control Based QoS Management for Real Time Traffic in Wireless Sensor Networks", Ma Y., Choi D., Ata S. (eds) Challenges for Next Generation Network Operations and Service Management. APNOMS 2008. Lecture Notes in Computer Science, vol 5297. Springer, Berlin.

[10] Koliver C., Farines JM., Nahrstedt K., "QoS Adaptation Based on Fuzzy Theory". Soft Computing in Communications. Studies in Fuzziness and Soft Computing, vol. 136(2004). Springer, Berlin, Heidelberg

[11] Rosa Maria Alsina Pagès, Clàudia Mateo Segura, andJoan Claudi Socoró Carrié, "Multiresolutive Adaptive PN Acquisition Scheme with a Fuzzy Logic Estimator in Non Selective Fast SNR Variation Environments", International Work-Conference on Artificial Neural Networks IWANN: Computational and Ambient Intelligence pp 367-374, 2007.

[12] Luci Pirmez L., Delicato F.C., Pires P.F., Mostardinha A.L., de Rezende N.S.," Applying fuzzy logic for decision-making on Wireless Sensor Networks", IEEE International Symposium on Fuzzy Systems Conference, pp. 1–6, 2007.

[13] Ishihara, J.Y.; Terra, M.H.; Campos, J.C.T. "Robust Kalman Filter for Descriptor Systems". IEEE Transactions on Automatic Control. 51 (8): 1354. doi:10.1109/TAC.2006.878741, 2006.

[14] Terra, Marco H.; Cerri, Joao P.; Ishihara, Joao Y. "Optimal Robust Linear Quadratic Regulator for Systems Subject to Uncertainties". IEEE

[15] Abbas Ali Rezaee and Faezeh Pasandideh, "A Fuzzy Congestion Control Protocol Based on Active Queue Management in Wireless Sensor Networks with Medical Applications",Wireless Personal Communications pp 1–28, Springer US. 21 August 2017.

[16] William Stallings," Data and Computer Communications, 8th edition" Book Chapter 4, ISBN: 0-13-243310-9, Prentice Hall 2007.

[17] Gauri S. Godbole, Shailaja Gaikwad," Comparative Study of Channel Estimation Techniques", IJEDR | Volume 4, Issue 4 | ISSN: 2321-9939, 2016.

[18] Brijesh Kumar Patel and Jatin Agarwal," Comparative Study of Bit Error Rate with Channel Estimation in OFDM System for M-ary Different Modulation Techniques", International Journal of Computer Applications (0975 – 8887) Volume 95– No.8, June 2014.

[19] Tirthankar Paul, PriyabratabKarmarkar, SauravDhar," Comparative study ofchannel estimation algorithms under different channel scenario", International journal of computer application (0975-8887), vol. 34. No. 7, November. [20] Gauri S. Godbole, Shailaja Gaikwad," Comparative Study of Channel Estimation Techniques", IJEDR | Volume 4, Issue 4 | ISSN: 2321-9939.2016,2011.

[20] **Brijesh** Kumar Patel and Jatin Agarwal," Comparative Study of Bit Error Rate with Channel Estimation in OFDM System for M-ary Different Modulation Techniques" International Journal of Computer Applications (0975 – 8887) Volume 95– No.8, June 2014.

[21] Mohammad NaserFawwazKhasawneh," Comparison study for Multi- user MIMO channel estimation techniques",August 2009, Jordan University of science and Technology.

[22] Systems Xenofon G. Doukopoulos and George V. Moustakides,, "Blind Adaptive Channel Estimation in OFDM", IEEE Transactions On Wireless Communications, Vol. 5, No. 7, July 2006

[23] Ishihara, J.Y.; Terra, M.H.; Campos, J.C.T. (2006). "Robust Kalman Filter for Descriptor Systems". IEEE Transactions on Automatic Control. 51 (8): 1354. doi:10.1109/TAC.2006.878741.