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ON-LINE OPERATIONAL DATABASE SYSTEM FOR UET POWER PLANT

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Abstract

A power station, the main source of electrical energy, is the principal dynamic entity in any electrical power system. Almost every active part of it generates information alongside its routine functionality. The present day thermal power stations (TPS) are quite complicated employing numerous sensors and control devices. Every sensor in a TPS generates lot of important data. One fundamental rule concerning data is that to be of value, data must be in the right form in the right place at the right time. At present this information is logged into "Shift Point" and "Load Calculation" registers for this purpose. The client – server database system proposed in this research would replace all kinds of data logging that is presently done in the log sheets. In the first phase of development, the operators in the control room would be able to enter the same information into the client-server database they used to write on the paper sheets. In addition to that the system would also provide an advice for sharing of load demanded by the central dispatch office according to the economical load sharing by making and adding some more features.

Keywords: power plant, operational database, thermal power station (TPS), power sources.

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1. Introduction

Thermal power plants constitute the largest proportion of installed capability of electrical energy in global power generation system [1]. A power station is the principal dynamic entity in any electrical power system. Almost every active part of it generates information alongside its routine functionality [2].The present day thermal power stations (TPS) are quite complicated employing numerous sensors and control devices. Every sensor in a TPS generates lot of important data. One fundamental rule concerning data is that to be of value, data must be in the right form in the right place at the right time [3]. Keeping a power station in its optimal operating condition require an insight and ability to access not only the attributes regarding economics of operation but also an ability to foresee any problems that may occur in a short or medium term operation.

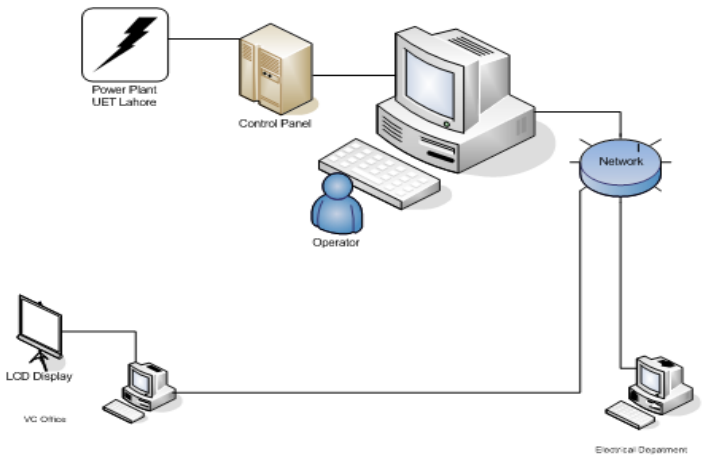

Fig. 1: Pictorial view

At present this information is logged into “Shift Point” and “Load Calculation” registers for this purpose. At the end of the month a summery is prepared and salient points about the economics of the operation are brought out in the form of a report. This is highly inadequate in the prevalent information technology era. The client – server database system proposed in this research would replace all kinds of data logging that is presently done in the log sheets pictorially shown in Fig. 1. In the first phase of development, the operators in the control room would be able to enter the same information into the client-server database they used to write on the paper sheets. All kinds of data processing may be taken care of by the database system [4]. In addition to that if this research is extended on further level, the system would also

provide an advice for sharing of load demanded by the central dispatch office according to the economical load sharing. The Gas Thermal Power Station (GTPS) built by the special interests of the worthy vice chancellor in the UET Lahore has two gas engine units each having capacity of 1.16MW. There are plans for installation of a 3rd unit which in view of the increasing load of UET would possibly be larger than the present two units. The development of such an operational client-server database system would facilitate the automatic economic dispatch system to keep the GTPS in an optimum economic condition all the time. In these days when world is suffering from the worst energy crisis, there is dire need to run power system on more reliable and economical conditions [5].

2. Rationale/Motivations

Most modern-day organizations have a need to record data relevant to the everyday activities. Many modern-day organizations choose to organize and store some of this data in an electronic database. There are 23 different mechanical parameters regarding the gas engines and 19 electrical parameters regarding alternators in UET Power Plant which are to be read and tabulated by operators hourly over 24 hours. Almost every active part of it generates information alongside its routine functionality. At present this information is logged into “Shift Point” and “Load Calculation” registers for this purpose. At the end of the month a summery is prepared and salient points about the economics of the operation are brought out in the form of a report. This inadequate situation in the prevalent information technology era put the authors to solve the problem more technically. Moreover the 42 parameters mentioned above a lot of parameters have to be calculated that might be erroneous due to manual calculations. Load-duration curved should be drawn to show load demand of consumer against time.

3. Methodology

As discussed above there are 23 different mechanical parameters regarding the gas engines and 19 electrical parameters regarding alternators which are to be read and tabulated by operators hourly over 24 hours. A client-server database system would be developed to log as much of this data as possible in this database. After that algorithms would be developed for extraction of heat input characteristics of the units

for later on usage in the economic operation of the plant as future research on this work [6]. Although at present there are only two units and economic sharing is achieved by keeping the load on them equal to each other, however its real worth would be more evident when a third unit is also added to the power station [7]. Database will be designed in Microsoft Visual Studio C#. The proposed database system would be web enabled to view the online reports from within the High Voltage and Artificial Intelligence in Energy Systems Laboratory [8].

4. Related Work

UET Power Plant consists of

Two GenSets running with gas fuel having capability of 1.16MW each.

One Diesel Generator of 325kW rating.

Two 11kV WAPDA feeders.

One GenSet of 1.16MW capacity has been planned in near future.

There are 19 parameters regarding each generator and 23 parameters regarding each gas turbine are recorded hourly. Few parameters regarding generator are listed below.

KW, AMP, VOLT, PF, HZ, KWH, LOAD%, W.TEMP L1, W.TEMP L2, W.TEMP L3 etc.

Few parameters regarding gas turbine are listed below.

HT TEMP, LT TEMP, HT BAR, LT BAR, OIL TEMP, OIL BAR, GAS FLOW Lb/Hr, MAIN GAS PSI, COOLING TOWER PH

All of above parameters are filled in different large tables and on the basis of these a lot of hectic calculations have to make on daily, monthly and yearly basis. Due to space constraint tables can't be shown here. Like hourly and daily parameters 'noted and calculated' mentioned above there are so many other parameters which are calculated and used for Cost Vs Benefit comparison and to draw load duration curve. Overall a lot of different parameters have to be recorded and calculated, a cost benefit comparison is done. At the end of 3 or 6 month load duration curve (a curve between load and time) is plotted for presentation.

5. Schema

There are four data sheets for two existing generators and two turbines which have to be filled hourly and then at the end of day total running hours, total energy in kWh and total gas consumption is calculated which is required to compare cost vs. benefit which is calculated at the end of year. So solution or schema is that an interface will be designed in C# that will provide "Selection Machine" option containing list of Generator 1, Generator 2, Turbine 1 and Turbine 2. After selecting any one of them as shown in Fig. 2 and entry boxes that will transfer that data to respective data sheet e.g. GenDS, TurDS etc. after pressing OK button

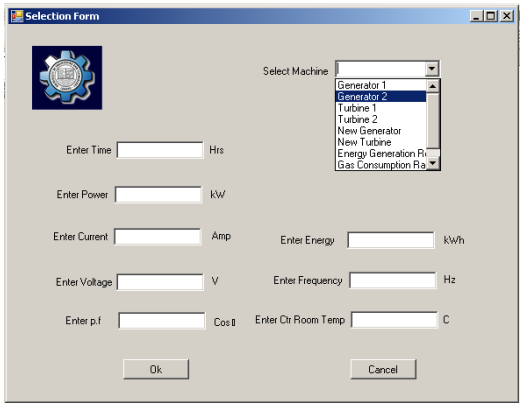

Fig. 2: Selection Form

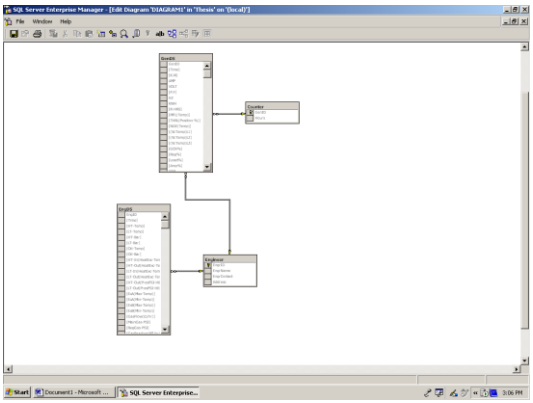

Fig. 3: Data Sheets in SQL Server

There are four tables designed in SQL database named Generator data sheet abbreviated as GenDS, Turbine data sheet abbreviated as TurDS, Engineer and Counter. The link between tables mentioned above is shown in Fig. 3. Engineer table which is basically the login table of Shift Incharge will allow entering the EngrID through a login form containing ID and Password provision shown in Fig. 4.

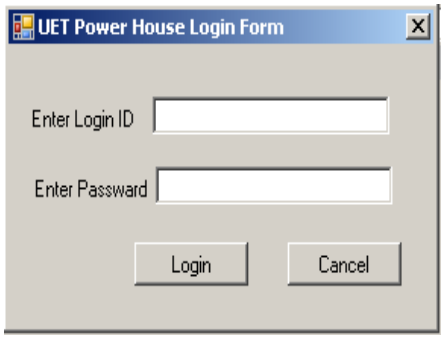

Fig. 4: Engineer/Login Form

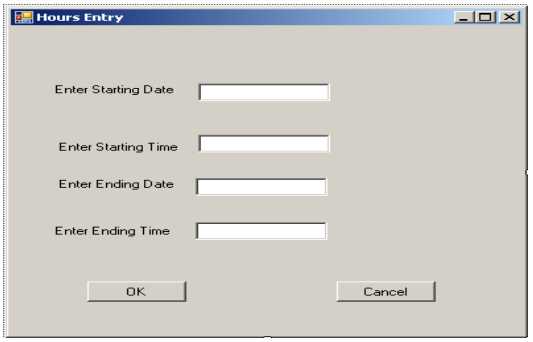

Fig. 5: Hours Entry Form

The information 'engineer name, engineer contact and address' about engineer will be present in Engineer table designed in SQL database against entered ID through interfaced login form shown above. After entering Engineer ID and his login in login form a selection form designed in C# will be opened like shown in Fig.2. Select any one of the option from selection form e.g. Generator 1. It will provide an entry form for Generator 1. After filling entries press OK, it will store entered data into GenDS table in database created in SQL against ID of Generator 1. Similarly select Turbine 1 and an entry form for Turbine 1 will be opened. Fill entries in Turbine 1 entry form that will be stored in TurDS table designed in SQL database. For each entry after one hour counter table will make increment in total running hours and update hour's coulomb in GenDS table, from where we can retrieve total running hours by running query if required for preparing a comparison 'WAPDA vs. UET Power House' report which will be run by selecting option " Running Hours" from selection form in Fig 2. To get generation report a PROCEDURE will be define in SQL that will get specified period and sum up kWh from GenDS table against specified period.

This PROCEDURE will be called by pressing OK button in 'Hours Entry' form shown in Fig. 5 and this form will run by selecting Generation Report option in 'Selection Form' shown in Fig1.

Fig. 6: General Flow Diagram

The above discussion can be shown by general floe diagram in Fig.6. To get Gas Consumption report a PROCEDURE will be define in SQL that will get specified period and sum up Total gas Consumption in M3 from TurDS table against specified period, like in case of Generation described above.

6. Results, Applications and Future work

This database proposed in this research would replace all kinds of data logging that is presently done in the log sheets. Profit vs. running cost plus capital cost is required to know the economics of the power plant which may be taken care of by database system.

Moreover to make the progress presentable load duration curve is drawn on board after 3 or 4 months which can be drawn daily, weekly, monthly and yearly whatever operator wants.

From this curve many other parameters like Average load, Maximum load, Load factor, Diversity factor etc. may be extracted for the study of Power Engineering Students.

All manual report generations would be replaced by well designing this operational database which will be able to display a quick overview of the economic parameters right in the VC office and Electrical Engineering Department for presentation to outside delegations.

It would be possible to make direct interface with control panels to get data by the permission of GenSet Company by interfacing the server directly panel's port.

New algorithms would be developed for extraction of heat input characteristics of the units for later on usage in the economic operation of the plant as future research on this work as the annual coal consumption is more than half of the country's consumption [9].

In addition to that the system would also provide an advice for sharing of load demanded by the central dispatch office according to the economical load sharing by making and adding some more features. It can enhance system efficiency and hence result in considerable energy savings and cost benefits [10].

7. Acknowledgements

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8. References

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