Design and Development of Data Logger of Reactive Power

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Abstract— In recent years, there is increased importance of Smart Grid, which includes monitoring and control of electric power consumption of customers. For this Wireless Smart Electrical Power Meter has been designed and implemented in which Wi-Fi wireless sensor network (WSN) will be used for wireless electrical power meter communication supported by microcontroller. Microcontroller will be used for power unit measurements i.e. for evaluating all electric power parameters at costumer side like Vrms, Irms, K_{VAH}, K_{Wh}, and PF. All these parameters will be sent through wireless network in order to be calibrated and monitored. If the RKVAH Lead reading is not available then old procedure of PF computation will be followed. To avoid the penalty we are going to "Design and development of smart monitor and data logger of reactive power".

Keywords—Secure Elite440, MAX485,Sim-Card

I. INTRODUCTION

Due to continuous increase of billing in industrial area and Loss of reactive power of electricity board, MSEB order Tariff 195 in September, penalty for power factor is introduced, whereas incentive is applicable in case of lag PF only. If PF level is less than 0.90 then penalty shall be taken by MSEB in there given order. If PF level is greater than 0.95 and R_{KVAH} Lag consumption greater than or equal to R_{KVAH} lead consumption then incentive shall be as per percentage given in MSEB order. If PF level is greater than 0.95 and R_{KVAH} lag consumption less than K_{VAH} Lead consumption then incentive shall not be applicable. If R_{KVAH} lead reading is not available then old procedure of PF consumption will be followed. To avoid the penalty, we are going to design data logger.

The monthly calculations of the power factor can be recorded in SD-CARD. If the power factor is below or above the range which is given by electricity board then the notification will be send to the user. This notification gives information about the Power Factor then notification will be checked by user. According to the range of power checked, the particular action will be taken by user. By doing this the penalty will be avoided, this is the advantages of design and development of smart monitor and data logger of reactive power.

The Formula calculated Power Factor given below:

$$PF = \frac{KWH}{\sqrt{(KWH)^2 + (RKVAH\ Lag + RKVAH\ Lead)^2}}$$

II. LITERATURE REVIEW

Authors in [2], have proposed a data logger to reduce the

penalties and this penalty can be reduced by balancing the Power Factor. The Power meter in this system is used to get the readings automatically and these readings are much efficient than manual readings. It also reduces the cost of measurement, manpower and hence system is efficient [2].

The output of power meter is connected through ModBus. This output will have provided to Arduino and Arduino is not compatible with the ModBus input.

Author in [4] has proposed system in order to reduce penalties, the system is provided with the Power Meter to calculate power factor and these Power Factor readings are stored into SD-Card. In this system the power meter is able to communicate with ESP8266 through ModBus protocol.
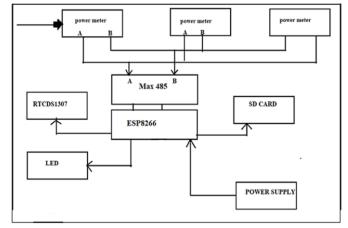
III. SYSTEM ARCHITECTURE

fig.1 Block Diagram

IV. BLOCK DIAGRAM DESCRIPTION

The figure 1 above shows the system architecture of the Data Logger. It contains following components:

ESP8266:
ESP8266 is an Ultra Low Power Technology has been designed for mobiles, wearable electronics and Internet of Things applications with the aim of achieving the lowest power consumption with a combination of several techniques. ESP8266EX uses about than 60µA in deep sleep mode (with RTC clock still running) and less than 1.0 mA (DTIM=3) or less than 0.5mA (DTIM=10) to stay connected to the access point. To satisfy the power demand of mobile and wearable electronics, ESP8266EX can be programmed to reduce the output power.

MAXRS485:
MAXRS485 is the transceivers with Low power used for the RS-485 and RS422 communication.

Secure Elite 440:
Secure Elite 440 is a multi-line three-phase digital panel meter which is used for accurate and reliable measurement of electrical parameters like voltage, current, power, frequency, etc. for industrial and commercial applications. This power meter has a large multi-line backlit LCD display which can enable four parameters to be displayed at the same time. Easy integration with energy monitoring systems will be possible because of Modbus communication capability of this power meter. Expansion modules can be fitted for enhanced system integration (pulse inputs/outputs or analogue output and ethernet).

SD-CARD (Secure Digital):
It is a non-volatile memory card format developed by the SD-Card association .SD-Cards are used in portable devices. The standard was created in 1999 by joint efforts between SanDisk, Panasonic and Toshiba.

V. METHODOLOGY

The proposed project is an expansion of smart monitor and data logger of reactive power

- In the initial phase the research, the data required for the project will be collected and the option which is open for implementation will be explored.
- In the next phase, the selection of component will be done. For example: microcontroller, sensors etc.
- The simulation will be done by using simulation tool 'proteus'.
- The components will be mounted on the Arduino Uno ESP8266.
- The building and testing of the proposed system will be done.
- Then the output of the system which gives information about the power factor is store into SD-CARD.

VI. EXPECTED RESULTS

- The monthly calculation of Power Factor will be recorded into SD-CARD and the user will able to get the data according to the need.
- Parameters like K_{VAH}, K_{WH}, I_{RMS}, V_{RMS}, and Power Factor can be recorded after particular intervals.

VII. FUTURE SCOPE

- Parameters like K_{VAH}, K_{WH}, I_{RMS}, V_{RMS}, and PF can be recorded and stored into SD-CARD for the period mentioned by a particular industry
- If the power factor is above or below the range mentioned by MSEB then user should be notified.
- As the system uses ESP8266 which is having Wi-Fi module, user can get notifications wirelessly.

VIII. CONCLUSION

This system is used to record and store the parameters like K_{VAH}, K_{WH}, I_{RMS}, V_{RMS}, power factor into SD-Card. User will able to get these data from SD-Card according to the need. It is used for the monthly calculations of electricity bill. The main objective of this system is to prevent the reactive power which affects the MSEB. And thus, user will be able to get

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