Charging by the Hot Heating Remote Monitoring System

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Abstract. Winter heating is one of the most important livelihood issues. Our heating costs in most areas by area measurement, although this method is easy, there are a lot of flaws. Heat mode of collection of heating charges as a more reasonable way of fee and people pay more and more attention. To this end, we designed heating and cooling module, the thermal monitor module, cost-measurement module on heat metering remote monitoring of the system. This system can monitor each user and each segment used in the various periods of heat based. On user consumption heat gauge heating costs and support online payment; the data collected through the heat used to analyze user' habits, with large data mining analysis method for decision of heating operation guidance, achieve calorie balance between supply and demand, energy-saving and emission reduction. Meanwhile, the system can achieve safety status monitoring and fault location to endure safety operation of heating piping.

Background of the Project

Currently most parts of the country according to the area of collection of heating charges , although this method is simple, but there are many problems, mainly in the heating-side two[1]:

Client:

1. Charge by the heat will lead to increased burden on the user.

2. Unreasonable fees. In area, without installing any heating equipment pool area is included in the range of heating fees, causing user dissatisfaction.

Heating-side:

1. The waste of the fuel increase environmental pressure. Heating is not based on our needs appropriate heating method, a lot of necessary fuel is consumed, meanwhile, emission of dust, sulfur dioxide and other pollutants caused great pressure on the environment.

2. The heating charge is not timely. Most community a collective form of heating. Heating fee, the charge of the district's property company, heating is often not timely collection of heating charges because of the property. The charging by the hot area in user units, quality of existing hot-o-meter is bad, inaccuracy. Manual charging method during the charging process, the efficiency is low. The phenomena is as follows:

1. Different users consume calories in different, worker need to go door-to-door to register relevant data, cumbersome.

2. User need to go specify sites to pay their heating costs. We will create a more scientific and reasonable heat billing systems based on the original to promote the application of charges in China.

The Overall Design

Works has been designed to simulate a user element, when many users are connected to form a scale effect of heat gains.

System Function. This system can monitor each user's use of heat in the various periods, and meter heating costs precisely by user's consumption of heat and support online payment [2]; by analyzing large data, we can offer guidance to the decision of heating operation, and achieve calorie balance between supply and demand.

1. Client-side

(1) The users can pay online by the consumption of heat [3].

(2) The users can adjust the room temperature to reduce costs.

2. Heating end

(1) Ensure pipeline security status monitoring and fault location to ensuresafety operation of heating piping [4].

(2)Our strategy is to learn the user's habits with big data analysis and adjust production [5].
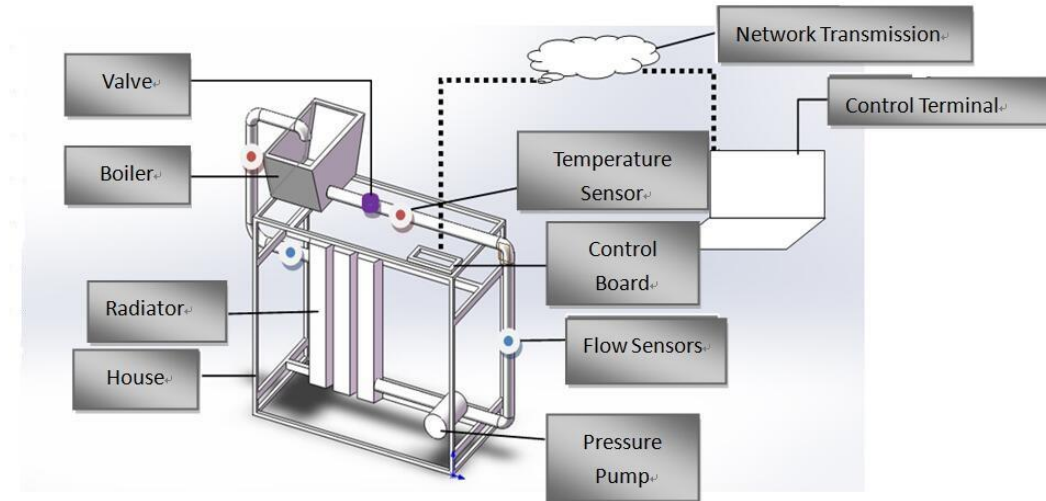
System Structure Chart.

Figure 1.   System structure chart

Working Principle. There are two temperature sensors and two flow sensors in the inlet pipelines and outlet pipelines [6]. So we can get inlet temperature, outlet temperature and liquid flow rat .Then the processor will deal with the data, and we can get the the number Q of calories the user consume in -, that is [7]:

$$Q = \int_{t_1}^{t_2} (T_1(\text{t}) - T_2(\text{t})) \bullet \text{v}_1(\text{t}) \bullet S \bullet d(\text{t}) \tag{1}$$

Among of them, S is the inner sectional area of the pipeline.

The data is transmitted to the remote control terminal through the GPRS and will be received by control terminal [8]. By treating and analyzing data, we can get the cost M Users need to pay, that is:

$$M = K_1(\text{t}) \bullet \int_{t_1}^{t} (T_1(\text{t}) - T_2(\text{t})) \bullet \text{v}_1(\text{t}) \bullet S \bullet d(\text{t}) \tag{2}$$

Among of them, $K_1(\text{t})$ is the rule of the payment.

System Operation and Test

We tested the device when we finished the work. We record data every 10 seconds in 6 minutes. The raw data are as follows [9]:

Table 1   Raw data

Time/s	0	90	180	210	240	270	300	330	360
Inlet Temperature/℃	44.0	43.5	43.0	42.8	42.6	42.5	42.3	42.1	42.1
Outlet Temperature/℃	43.6	43.1	42.6	42.3	42.1	42.1	42.0	41.8	41.7
Flowrate/L	4.2	7.9	12.6	13.1	13.8	15.4	16.9	18.3	18.7

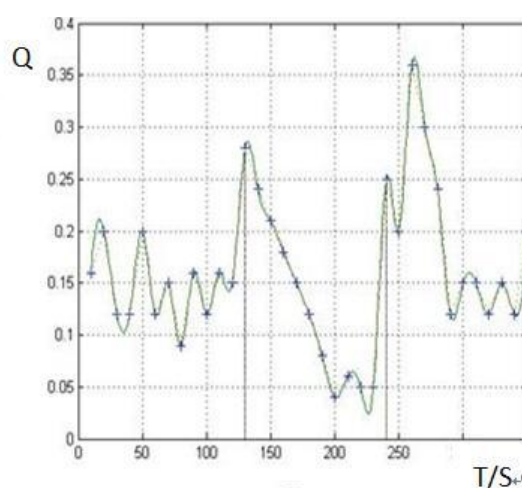Then we deal with the data and throttle.

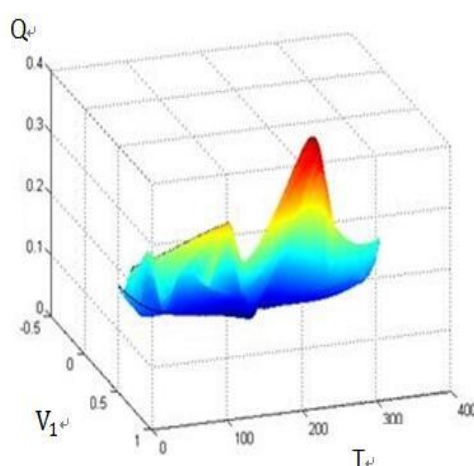Figure 2.   The relationship between Q and T

Figure 3.   The relationship among Q ,T and V

Conclusion 1: From Fig. 2, we know that there are two dramatic changes in the process [10]. The first trough reflects the user's turn off valve action, so as to reduce the amount of heat consumption. The first peak reflects the user's open valve action, so as to increase heat consumption. This illustrates that the user can adjust the amount of heat used by adjusting the valve opening, so that the indoor temperature can reach the appropriate temperature and avoid unnecessary heat waste.

Conclusion 1: From Fig. 3, we can know the relationship among the flow rate, the consumption of heat speed and the time of the dimensional and are in accordance with the actual results.

Application Prospect

Based on the combination of thermal metering heating costs and Internet technology, The system achieve the wireless transmission of heat data, remote monitoring heating system, online payment related costs and other functions.

Compared to the traditional heating and charging methods, our method is more efficient and convenient. At the same time, the use of large data analysis regulate heat production, so as to realize energy saving and emission reduction.

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