Investigation of Monitoring System on Air Conditioning Used by EER Value IoT Technology

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***Abstract*-A performance monitoring of wall-type air conditioners cannot be monitored in real-time due to the need to attach various types of measuring equipment. Therefore, in order to be easy to check and be the most current, IoT technology is introduced to facilitate the examination. In this research, IoT design and construction for air conditioning control and inspection using Blynk application. The monitoring system will be designed and installed via a smartphone application. It will be collected data to calculate the EER value in analyzing the efficiency of the air conditioner. It was found that actual measurement and Blynk application closely EER values. The use IoT technology can be significant to performance air conditioners.**

Keyword: IoT technology, wall-type air conditioners, EER values, Blynk application

I. INTRODUCTION

Thailand is located in Southeast Asia with a tropical climate combined with variable climate makes us unable to predict the weather [1]. Therefore, the air conditioner came into being one factor that is important to human life, both the household and industrial sectors, in which the energy usage statistics of air conditioners according to the National Statistical Office found that the use of air conditioning energy has increased to 15.6%. From the use of all electrical equipment and an increase of 50.6% in the use of air conditioners in the summer [2], which air conditioners are a type of equipment, so it is necessary to have equipment measurements for maintenance and be aware of system performance in order to reduce problems that occur in use and reduce repair costs, both for oneself and for country.

The split type air conditioners are popular air conditioners used in the household sector, due to the quiet sound due to the heat sink being separated into other places. Therefore, this type of air conditioner is preferable for homes that require air conditioning. That is not very large and not many rooms, or if there are many air-conditioned rooms but may be used Each air-conditioned room cannot simultaneously be air-conditioned mobile typically cooling will not exceed 40,000 BTU per hour [3], which can be turned - off the air conditioning needs to implement energy-saving measures for adjustment. In the industrial sector, users of the first split type air conditioner need to know the energy measurement index of the air conditioning system first. Which the measurement index is as follows: electrical charge of the compressor temperature and relative humidity of the air supply temperature and relative humidity of the wind, wind speed and cool air distribution area temperature and relative humidity of the air entering the condenser and use the following measuring tools electrical properties, temperature, relative humidity and wind speed, respectively.

The first step is to check the performance of the systems and equipment that use energy in the system to check the performance of the system and the equipment that uses energy in the system, which should be carried out consistently and consistently. In order to compare with the original capacity is reduced before finding ways to improve to increase performance or to change a new machine [4]. Since the tools used to measure the efficiency of air conditioners are quite expensive and it is difficult to go through the measurements and it is necessary to record the index data for comparison of the original capacity and the analysis detailed information requires those with direct knowledge and experience, which must accept that entrepreneurs in the industrial sector most SMEs are still not ready in this area, and in order to save energy that provides a worthwhile return for entrepreneurs in the industrial sector, which, if operators continue and seriously, will resulting in maximum energy efficiency can benefit both the operators themselves and the country indirectly.

This research has the concept of using internet of thing technology (IoT) [5-6] by working Arduino family microcontroller and ESP8266 with Blynk application [7], which is an application Blynk application came to help solve the problem of measuring the performance of

air conditioners in confined spaces and recording the index data to compare the original performance of how much is reduced by recognizing changes in various index values with Blynk application, which is a free application that records and displays hardware performance in real-time via a smartphone.

In order to track the energy efficiency ratio (EER) index [8-9] in each period of the air conditioner operation, it is convenient and quick to analyze the data to improve the efficiency of the air conditioner, saving energy and using the most efficient energy. The Blynk application can further extend to control the microcontroller at the pin level, allowing control over the device via the application as well.

II. EXPERIMENTAL SETUP

Creating a display system and checking air conditioning performance using EER has studied data and analyzed data, hardware design, software design, hardware installation and testing hardware devices together with the written code.

A. Hardware Design

The design of various components such as the control board part, the sensor connection to the control board, and the position of the sensor mounting position in the air conditioner system are designed to use the least amount of equipment. The creation of the sensor connection kit uses the Arduino NodeMCU V.3 with PZEM-004T and DHT22. Air conditioning installation points will be installed in the front of the cooling fan and cooling coil to measure wind speed and temperature for EER value.

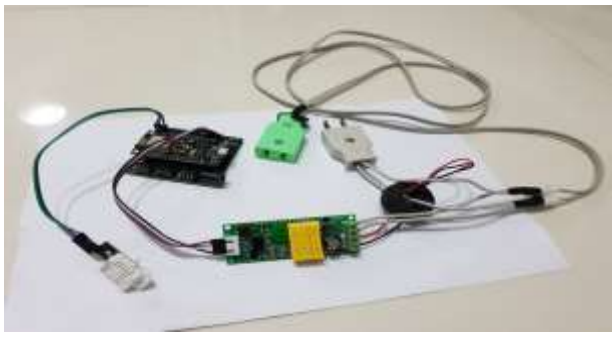

Fig. 1. Assembling Arduino NodeMCU V.3 with PZEM-004T and DHT22

B. Software Design

A study on the control code and writing in the arduino program then try to run the code that is studied or not, and then modify the code to complete and then add the code to the straps in the arduino NodeMCU V.3.

Working in contact to the Blynk Server using contact via the Blynk Library will use a temperature sensor to measure the temperature, temperature sensor, thermal conductivity sensor, complete moisture measurement by calculating the difference between the conductivity Air heat and current sensor Hall effect sensor is an indirect current measurement.

Hall Effect sensors are located in the magnetic field lines of the wires will send out the contract. According to the magnetic field level as shown in Figure 1. The measurement will be forwarded to the Microcontroller NodeMCU V.3 and processed to the Blynk Library and displayed on the smartphone screen.

III. EXPERIMENT RESULTS

From the system design showing the air conditioning capability, can be seen that the air-conditioners capable of detecting the performance of the air conditioner can have 2 values: the EER and the COP.

Analysis of experimental results from values recorded in the database of cloud server by recording every minute through the Blynk application checking current values via the internet, as shown in Fig. 2.

Fig. 2. the EER and the COP. of the air conditioner by Blynk Application

Analysis of the experimental process by comparing the relationship of the equation, energy coefficient and the capability coefficient to be converted into a sensor test program instruction and compared with the standard measuring instrument to determine the error of the sensor.

Figure 4 shows the comparison of actual instrumentation measurements and the use of the Blynk application for the temperature on air conditioning sensors. In this research, sample testing at a 60 min. It was found that the average temperature measurement at 24.32 °C using Blynk application is less than the actual measuring instrument 25.1 °C which has an average deviation of 3.1%

5/23/2019 17:57	Humidity	56.54286	Temperatu	28.8	V	231.5143	I	5.231429	P	1200.286	P	1200.286	E(wh)	5623.429	E(kwh)	5.623429	EER	8.498	COP
5/23/2019 17:58	Humidity	56.65714	Temperatu	28.78571	V	231.8	I	5.235714	P	1201.571	P	1201.571	E(wh)	5643.429	E(kwh)	5.643429	EER	8.489	COP
5/23/2019 17:59	Humidity	56.6	Temperatu	28.75714	V	232.0143	I	5.222857	P	1199.286	P	1199.286	E(wh)	5663.571	E(kwh)	5.663571	EER	8.505	COP
5/23/2019 18:00	Humidity	56.55714	Temperatu	28.75714	V	232.2286	I	5.184286	P	1190.571	P	1190.571	E(wh)	5683.429	E(kwh)	5.683429	EER	8.567143	COP
5/23/2019 18:01	Humidity	56.54286	Temperatu	28.72857	V	231.7625	I	5.205	P	1194.625	P	1194.625	E(wh)	5704.75	E(kwh)	5.70475	EER	8.53825	COP
5/23/2019 18:02	Humidity	56.47143	Temperatu	28.7	V	231.4857	I	5.221429	P	1195.714	P	1195.714	E(wh)	5725.857	E(kwh)	5.7245	EER	8.529667	COP
5/23/2019 18:03	Humidity	56.4	Temperatu	28.7	V	231.2857	I	5.217143	P	1194.571	P	1194.571	E(wh)	5745.857	E(kwh)	5.744375	EER	8.5385	COP
5/23/2019 18:04	Humidity	56.38571	Temperatu	28.7	V	231.2714	I	5.221429	P	1196.143	P	1196.143	E(wh)	5765.857	E(kwh)	5.765857	EER	8.527143	COP
5/23/2019 18:05	Humidity	56.48571	Temperatu	28.7	V	231.2714	I	5.19	P	1187.286	P	1187.286	E(wh)	5785.714	E(kwh)	5.785714	EER	8.591143	COP
5/23/2019 18:06	Humidity	56.41429	Temperatu	28.7	V	231.2286	I	5.154286	P	1179.429	P	1179.429	E(wh)	5805.429	E(kwh)	5.805429	EER	8.648143	COP
5/23/2019 18:07	Humidity	56.34286	Temperatu	28.7	V	231.3143	I	5.148571	P	1178.286	P	1178.286	E(wh)	5825	E(kwh)	5.825	EER	8.656857	COP
5/23/2019 18:08	Humidity	56.4	Temperatu	28.7	V	231	I	5.154286	P	1178.429	P	1178.429	E(wh)	5844.714	E(kwh)	5.844714	EER	8.655429	COP
5/23/2019 18:09	Humidity	56.32857	Temperatu	28.7	V	230.7714	I	5.151429	P	1176.143	P	1176.143	E(wh)	5864.286	E(kwh)	5.864286	EER	8.672286	COP
5/23/2019 18:10	Humidity	56.34286	Temperatu	28.67143	V	230.7429	I	5.144286	P	1174.714	P	1174.714	E(wh)	5883.857	E(kwh)	5.883857	EER	8.683143	COP
5/23/2019 18:11	Humidity	56.25714	Temperatu	28.68571	V	230.6143	I	5.124286	P	1170.143	P	1170.143	E(wh)	5903.429	E(kwh)	5.903429	EER	8.716857	COP
5/23/2019 18:12	Humidity	56.3	Temperatu	28.7	V	230.9429	I	5.121429	P	1170.857	P	1170.857	E(wh)	5922.857	E(kwh)	5.922857	EER	8.711714	COP
5/23/2019 18:13	Humidity	56.3	Temperatu	28.65714	V	230.3714	I	5.175714	P	1181.429	P	1181.429	E(wh)	5942.429	E(kwh)	5.942429	EER	8.633571	COP
5/23/2019 18:14	Humidity	56.51429	Temperatu	28.6	V	230.7857	I	5.165714	P	1179.571	P	1179.571	E(wh)	5962.286	E(kwh)	5.962286	EER	8.647286	COP

Fig. 3. Example database exported from Cloud Server

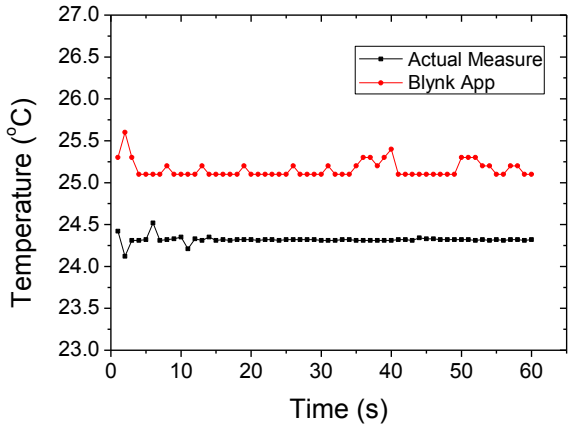

Fig. 4 The comparison of actual instrumentation measurements and the use of the Blynk application for the temperature on air conditioning sensors

Figure 5 shows the comparison of actual measurement instruments and the use of Blynk application for power from the air conditioning sensors. It has been found that measuring power at 2.39 kW using Blynk application is greater than the actual measuring instrument at 2.49 kW which has an average error of 4%.

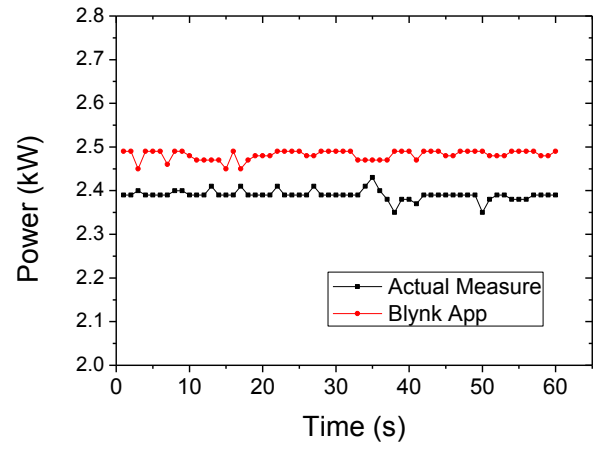

Fig. 4 The comparison of actual instrumentation measurements and the use of the Blynk application for the ower on air conditioning sensors

According to TIS 1155-2536 Air-cooled Split Type Room Airconditioners [10] are designated as "Energy storage. EER performance ratio means the range between the total net cooling capacity of the machine and the power rating standard test conditions". To be able to compare, the efficiency level of the air conditioner with less power consumption at work.

Figure 6 shows the energy efficiency ratio (EER) of air conditioners by comparing and comparing the actual measuring tools and using the Blynk application. It has been found that the energy efficiency ratio values using the Blynk application and the actual measuring instrument values at 5.5-5.8% which has an average error of 2.32%

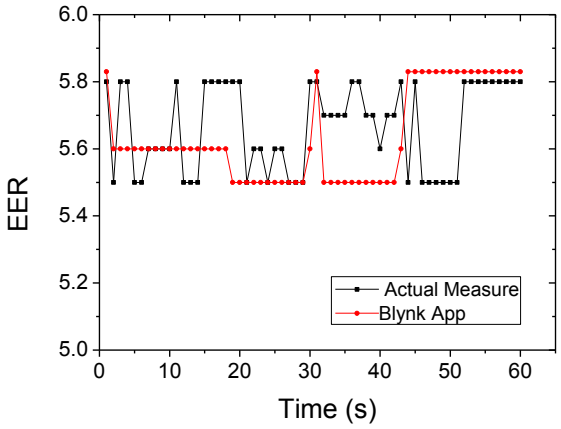

Fig. 6. EER of air conditioners by comparing and comparing the actual measure and Blynk application

IV. CONCLUSIONS

Air conditioning performance display and checking system by using EER (Energy Efficiency Ratio) can measure the calculated value actually received, can also check and store data via the internet. This Blynk application may be show a model for applying or improving for higher efficiency. It may be a tool to help those interested in studying which can be applied in daily life from the testing of air conditioning performance by using the EER value IoT technology.

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