RFID Electrical Power Meter

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***Abstract*— This paper presents a RFID Electrical Power meter that can effectively used for energy budget and energy saving. The paper presents the meter in general concept and shows some experimental works carried out to test the meter. Electricity usage record also will be shown using RFID electrical power meter.**

***Keywords*—RFID Electrical Power Meter, electricity usage, energy saving**

I. Introduction

RFID technology had been introduced seen nineteen century. RFID is using RFID card to active electrical devices. To activate the electrical devices, there must be a RFID reader where it can read the card secret code. Whenever the secret code of the card matched with the code programmed or stored in the controller, then the controller will activate the devices.

Currently RFID technology is widely used in door access identification. The RFID is used to identify a legal person that access to a door [1]. Whenever the card is scanned, the reader or controller will identify that card and verify the card. If the card is legal, then access is granted, else access is deny.

Apart from controlling the door access, RFID technology also can be implemented in electrical power meter to control amount of energy usage. When used in electrical power meter, the main task of RFID is to activate the meter and allows the electricity supply to the building. Whenever the electricity usage is high, the deduction of credit is also very high. When the credit is low, the system will produce a beep sound alert the user. When the credit is completely zero, the electricity supply will be cutoff.

II. PROPOSED DESIGN OF RFID electrical power meter

A. *Tecnical Design*

The design of RFID electrical power meter involves few parts of the circuits such as power supply circuit, microcontroller circuit, automatic sleep mode circuit and IR sensor control circuit.

In general, the proposed RFID electrical power meter is shown in Figure 1.

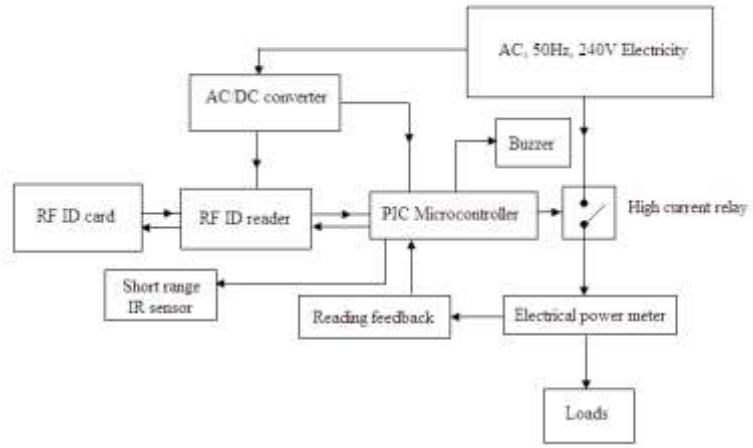

Figure 1. The proposed RFID electrical power meter.

As shown in Figure 1, PIC microcontroller responsible to triggers the relay, turn off and on the RF ID reader. Once the RF ID card is authenticated, PIC microcontroller will send digital signal in HIGH to make the connection between AC, 50Hz, 240V power supply to electrical power meter and hence the loads. Direct trigger the relays is not possible, there will be power transistor used draw more current so that relay can be activated. PIC microcontroller also responsible collect the information from the loads (amount of electricity used) and process the credit deduction. When more loads are used, the deduction of power credit will be more. Similarly, when less load are used, less deduction or slow deduction process is done by PIC microcontroller. The power credit left and displayed on LCD also is the task of PIC microcontroller. When power credit is less, the buzzer will beep before the electricity power supply is disconnected.

Note that AC/DC converter is needed to provide 5V DC for PIC microcontroller and 9V for RF ID reader. This suggests that a different DC voltage divider has to be constructed in order to achieve different voltage [2].

The IR sensors used in the system is to detect an object approach the energy meter. When anybody approach the

energy meter, the RFID reader will turn on immediately and ready to be activated by legal card. However, when no one approaches the card reader, the card reader machine will switch to sleep mode after 3 minutes. This is important to make sure the reader is not turned on all the time while the meter is running. Hence, save the power. The IR sensors and transceiver used will sense an object in a short distance of said about 10cm. The IR sensors used here will be protected against from fluorescent light and other harmonic of light interference.

B. *Maintaining the stability operation of the IR sensor*

From the proposed technical block diagram, there is one part of the circuit which is the IR sensor that sensitive to the light. The IR sensor used in this proposed RFID electrical power should put horizontal faced to detect the object near by. The sensor has to be shield from other light source to prevent interference.

III. Programming design

The working of RFID electrical power meter is very much depends on the program embedded inside the microcontroller. To successfully perform the task of supply and cutoff the electricity, programming design on accuracy measure of the credit value is very important.

The proposed programming design can be seen in Figure 2 where it is summarized into flow chart [3].

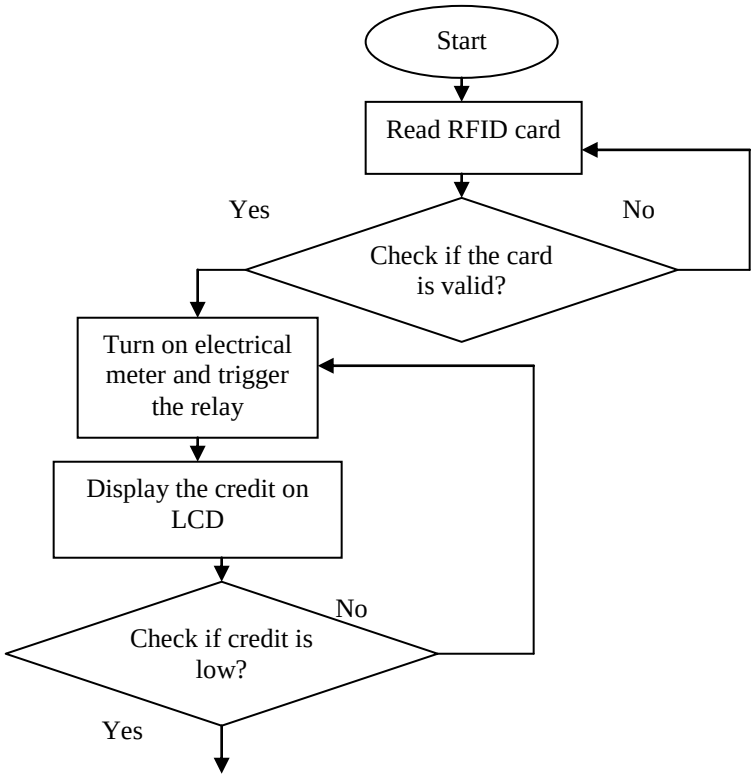

Figure 2. The main program design to control the electricity turn ON/OFF.

From the flow chart, the program designed embedded into the microcontroller will read the RFID reader output signal. Once it reads the RFID reader signal, the program will check the validation of the secret code. If the code is matched with the one store in data base, then the microcontroller will trigger the relay so that that electricity can supply to the load. Otherwise, the program will make the microcontroller continue reads from the RFID reader.

When the microcontroller has granted the verification, it will turn on the relay so that electricity can be supplied to the load. The amount of credit also will be shown in the LCD display.

Each usage of electricity will be measured and the credit will be deducted accordingly. When the credit becomes low, the program will make microcontroller trigger the buzzer so that user can be alerted on low credit. When user does not want to top up the credit or buy a new power, then the system will cutoff the electricity supply.

IV. RESULTS

Few results will be shown to experimentally test the RFID electrical power meter. Figure 3 shows the RFID electrical power meter. Figure 4 shows the display of power left in the LCD screen.

Figure 3. RFID electrical power meter for testing.

Figure 4. Test on power usage.

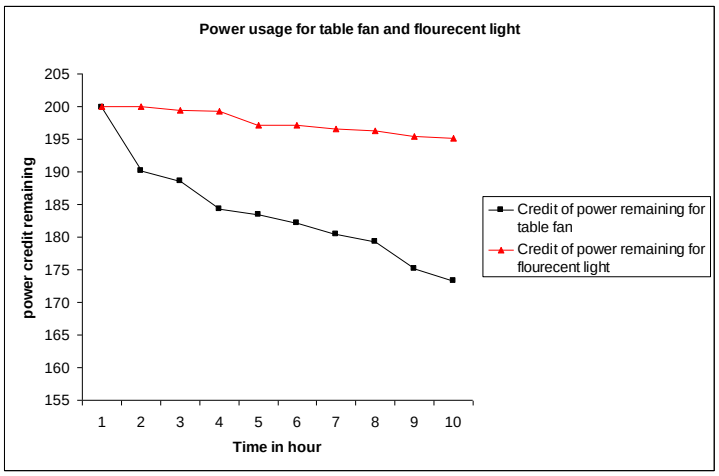

Figure 5. Power credit left experimental for table fan and fluorescent light.

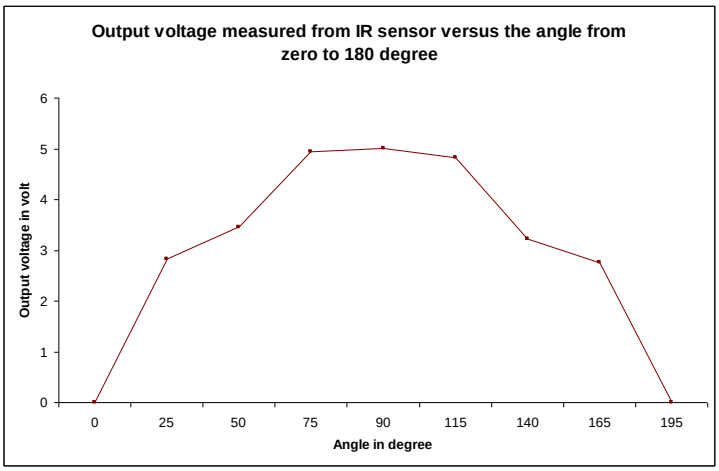

Figure 6. IR sensor output voltage measurement.

Figure 5 shows the graphs of testing the 65W table fan and 40W fluorescent light. Figure 6 shows the result of IR output voltage measurement.

From Figure 5, the result shows that 65W table fan consume more power than the fluorescent light. Because of this, there is much credit of power deduction when table fan is connected to the RFID electrical power meter. 40W fluorescent is a energy saving type of light. As such, not much of power deducted when connected to RFID electrical power meter.

Figure 6 shows the measurement of IR transceiver sensor output voltage in DC. As seen in the graph, the receiving sensor produced 5V when ever the object detected is approaching 90° faced directly to the sensor. The voltage produced is less when an object is come from the side of the sensor. As a result, when come to activate the RFID electrical power meter from the sleep mode, one has to come at 90° near the IR sensor. Typical detection ranges is from 0.5m to 1m from the distance of the RFID electrical power meter.

V. CONCLUSION

From the experimental works, it is seen that the higher the load power, the more the credit will be deducted. It is advice the user to top up high power credit if the usage of the electricity is found to be high.

For the IR sensing system, it is advise also user has to be very near to the sensor in order for the detection to be clear and stable.

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