

Everyone's Smart University

Project (Spring 2021)

Student Name	Faisal Abdullah Almehainy	اسم الطالب
Students I.D	2021200708	الرقم الجامعي

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RFID POWER COMPENSATION TECHNOLOGY

I.INTRODUCTION:

This project is about the design and implementation of RFID control system to compensate the power in the grid. For example, if the grid does not enough power, the system will automatically inject the power into the grid. For the RFID, it is used to identify a person login into the system compensation. Once the RFID reader authorized the ID card, the power compensation system will start to work and giving power away from the storage.

Besides the power is giving away from the storage, the system developed also consists of display unit. This display unit will show the amount of power left once it is delivering out from the storage. The storage can be a battery or backup AC generator. Figure I.1 summarized the system design of this project.

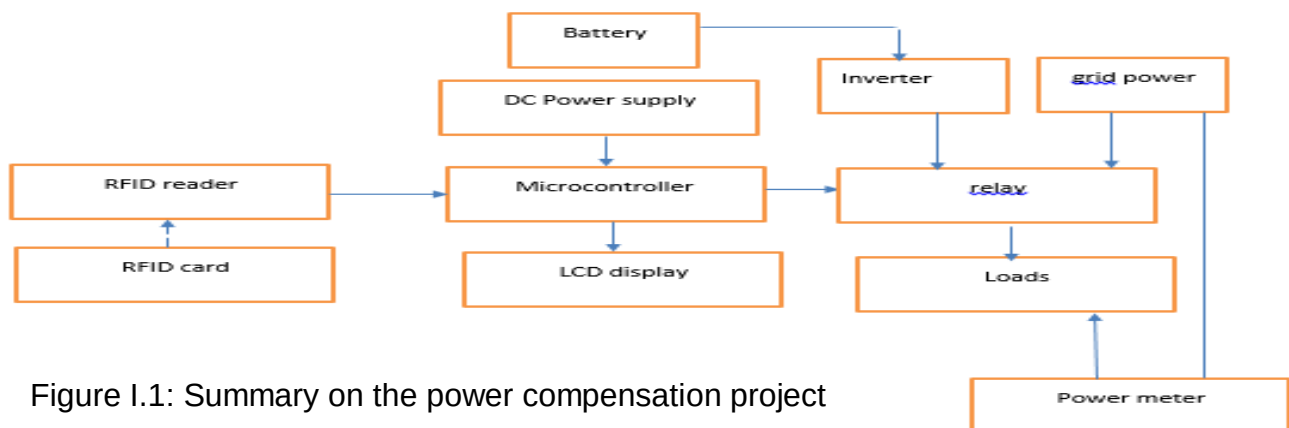


Figure I.1: Summary on the power compensation project

From Figure 1.1, it is seen that there is a relay connected in between the power sources and the loads. Note that the power sources are two: one is coming from the grid and the other is coming from inverter. The one coming from the inverter is a backup power. As the grid power is less, the microcontroller controls the relay to switch the power from grid to the inverter. As such, the power then continues supply to the loads.

II.RELATED WORK

Although the same projects cannot be found, but at least the concept and the principles are there. In the past, it is believing that there were many similar projects like this. But not all of them will be reviewed at here. Some were very old or using old technologies. If those using old technologies appeared to be in the past, then they will not be discussed in this section. The year limited for the latest projects are 5 years. The main important thing is the technology used must be a latest of upgraded technology.

In the paper of "RFID Power Control System", a set of microcontroller circuit together with RFID circuit are integrated together. When the RFID tag placed on the reader, the reader will detect and identify the tag. If the tag is valid, the microcontroller will trigger the relay and hence the power is delivering to the loads.

Another paper presented in the past presented "RFID switching for Power Deliver to the Loads". In this paper, the MOSFET switching is proposed instead of using a physical relay. With is MOSFET, the switching get advantage in a way that it is soundless.

MOSFET has better switching capability and it is faster than the physical relay. Also, due to its characteristics of switching. This MOSFET performance twice the speed of physical relay in switching, A high current MOSFET also can be found in the market.

Another proposed research is "Power Compensation Integrated with Solar Panel". In this research, the solar panel received the sunlight from the sun. The panel converts the light energy into electricity. With the inverter implemented in the system, the DC energy is converted into AC energy. This AC energy is then feed into the grid with the help of switching. The basic idea for this scenario is shown in Figure II.1.

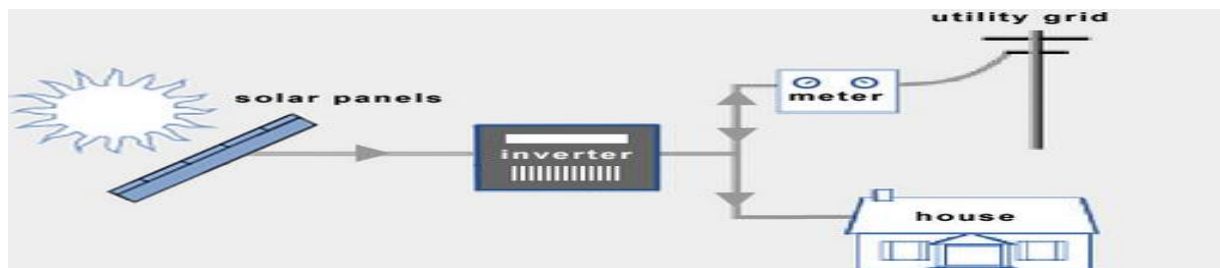


Figure II.1: Basic idea on the power compensation from the solar panel

Another research found in the past of few years related to this project is the compensation of power using high performance of RFID. The high-performance RFID

III.METHODOLOGY

The simulation results must be satisfied before comes to lab test. Once it is in the lab test, the prototype or the project is consider 80% complete. In lab test, the components or the stage of the circuits will be tested using mustimeter or oscilloscope. Mustimeter is mainly used to check the voltage and current in the circuit. It is also used to check the connectivity of the circuit. Oscilloscope on the hand is used to measure the output waveform. Finally, the circuit is converted into PCB and ready for prototyping. The prototyping will be considering the last part of the design. This phase implemented only when everything is correct without error.

Figure 3.2: Schematic diagram for power compensated system with RFID

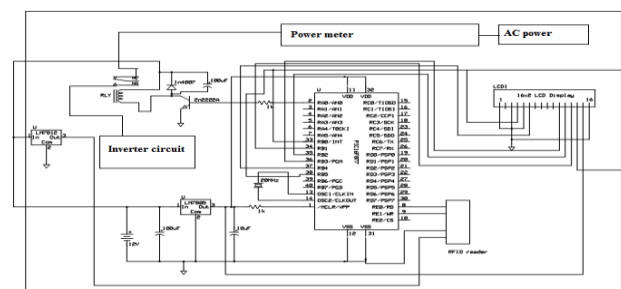




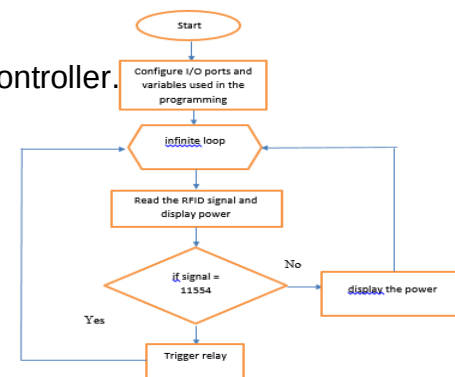
Figure 3.2 illustrates a complete schematic diagram design for the RFID compensated power system. Note that the main component in the circuit is the PIC16F877A microcontroller. This microcontroller is a programmable device. It is programmed to read the RFID signal, process the signal and display access granted or deny when the RFID card is valid or invalid. The RFID reader is connected at pin 8 and 9. These two pins are reserved for data read in, especially for the RFID. From the schematic diagram, the LM7805 is a voltage regulator. This regulator step down the voltage from 12 V into 5 V. With two capacitors 100 uF and 10 uF, the voltage supplies to the microcontroller is stable and controllable.

The relay circuit is connected at the port B of the microcontroller. This relay perform the switching between the main grid and the inverter. At the initial stage, the load get the power from the grid. When the grid shutdown, the relay will switch the power to the inverter circuit. Hence the loads continue to work without breakdown.

3.3 Programming Design The working of the circuit shown in

Figure 3.2 is depending on the program downloaded into the microcontroller.

This section presents the programming design to trigger the relay. and shows the condition of the identification when RFID card is placed on the reader. The complete program design for this project to trigger the relay and shown the authentication on the LCD display.



Express schematic software is used to design a schematic diagram, for any circuit. This software is very flexible to use. It is free hand sketching like drawing. Therefore, designer is free to sketch any things in the workspace. For the components, Express schematic gives a convenient way to draw a custom component and save it into the library for future used. User also can insert the text in the Express schematic. For Express PCB, it is used to design a PCB layout. Express PCB is easy to use with few steps of setting, all the guidance are come out and hence making the design fast and effective. Another good thing about the Express PCB is, all the components are the actual physical size.

Therefore, the designer does not need to change or configure the components. shows the circuit build on the breadboard ready for testing. The RFID reader has three wires connections. The following shows the wire colour and connection points:

TABLE 3.1: Wiring for RFID reader

Wire colour	Function
Red	Connect to 12 V positive
Black	Connect to 12 V ground
Grey colour	Connect to 12 V positive
Yellow	Connect to PIC microcontroller

Before the PCB layout is printed out, the PCB layout itself must be designed. Figure 3.7 depicts the PCB layout for the compensated power with RFID.

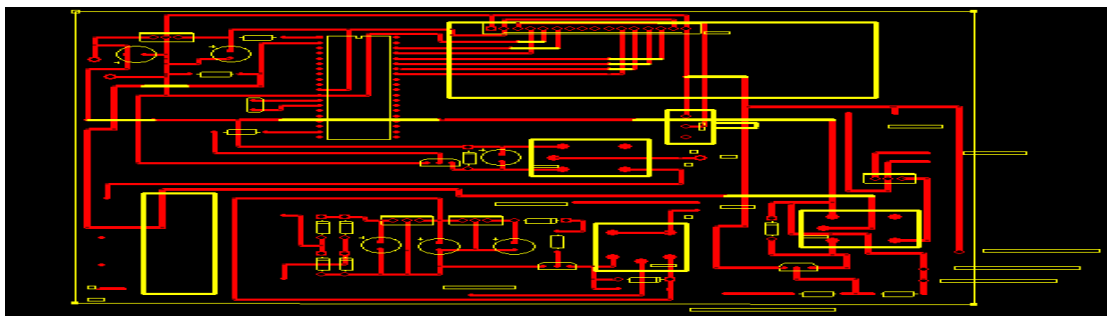


Figure 3.7: PCB layout design

In PCB layout design, one must know the top layer and bottom layer. This should make clear so that the pads can be inserted and the pads can be drilled hole after etching. Another things have to concern in the PCB layout design is the short circuit and open circuit. Short circuit causes the power supply generate low voltage and high current. Apart from that, it causes the damage of the components if the design is too bad and too much problems. Short circuit normally happen when two or more conductor lines are touch to each other. The lines are usually live and neutral or positive and negative. For open circuit, there is no current flows in the circuit. Open circuit causes the circuit has respond when power is injected into the circuit. Open circuit usually happen because the broken conductor lines. To troubleshoot open circuit, jumper wires are used. Jumper wire is used to connect the broken lines together. Hence, the current can flows through the open circuit



path. The next process after PCB layout design is the PCB printing process. This process print out the PCB layout ready for physical PCB making. Figure 3.8 shows the PCB layout print out using laser printer. The PCB layout print out must use the laser printer. This is to avoid the image disappear when heat is applied on it. Laser printer and the A4 size transparent paper are the best option to print out the layout.

Once the PCB layout is printed out, the next process is ironing or heating. Figure 3.9 illustrates the ironing or heating process.

IV. RESULTS AND DISCUSSIONS

The measured output voltage is 5V DC, this 5 V DC will be used to power up the microcontroller. Typical voltage regulator used is LM7805, which regulate the voltage down into 5 V because capacitor with high capacitance values in used, the ripper is then removed, and the outcome of the voltage is DC. To further maintain the DC voltage level, a voltage regulator is used. This regulator only works when the input voltage is larger than 5 V.

The inverter is used to convert DC into AC. In this project, the inverter circuit provides backup power supply to the grid. This means that when the main power is breakdown, the inverter circuit will be used to power up the loads.

The inverter circuit basically converts the DC energy from the battery into AC. The output AC has a same voltage and frequency as the grid AC power source.

From the experimental test results of the inverter circuit, one can see that the DC energy goes through few steps changes before fully converted into AC. The 0DC energy from the battery is first converted into sawtooth wave, then becomes square waves. This is done at the oscillator circuit. The reason needs to convert the DC into square wave is to obtain the frequency of oscillation. The square is a preferred waveform because it is easy to convert into AC after inversion.

Once the square wave is obtained at the output of the oscillator, the inverter will then invert the square wave and enhance it to become a 12 V sinewave. By using step up transformer (12 V/1240V), the output 240 V will be obtained at the primary of the transformer. The voltage used in this experiment is 5 V DC.

As can see from the test results, when switching occurs, it can be 0 V or 5 V depends how user connect the switching to the circuit.

When a wrong RFID card is placed on top of the reader, the reader start to identify the card and gives response through the LED



Figure 4.11: Correct RFID card used

illustrates the power meter that will be used to measure the power of the load. Note that the power meter not only can measure the power, but also measuring the voltage, current as well as the energy. The datasheet of the meter shows that it is capable to measure the load power up to 1 kW. For the current, it can measure up to 20 A maximum.

Note that, at this moment, the power meter is only showing and not connected to the load. Later when comes into final circuits, it will be used to measure the power of the loads as well as the loads current.

V. Summary

The experimental results were carried out part by part in the circuit. Lastly the whole project was tested to see the outcome. Part by part testing of the circuit is important. This can ensure the last part or the whole project is working.

It is seen that the results are optimistic and most of the parts are working. The RFID is able to detect a correct tag and trigger the relay so that the power is delivered to the circuit.

VI. reference

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