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Design and Development of Automated Lighting Rental System for Common Barangay Facilities

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Abstract*: *This paper entitled Automated Lighting Rental System for Common Barangay Facilities sought to address the issues encountered by some users regarding the need of lights during their games in barangay Bulua, Cagayan de Oro City. The system was designed with an automatic mechanism that controlled the electric lightings comparable to pre-paid electric hour consumption by means of a bill acceptor. The developed device was equipped with a thermal printer that prints the receipt after using and a Liquid Crystal Display (LCD) to display the number of hours used. Arduino Mega 2560 was used to implement the system control concepts relative to its corresponding input and output relationship and control framework. The device's bills acceptor where the users has to insert can detect a twenty peso bill, fifty peso bill, one hundred peso bill , a five hundred peso bill and one thousand peso bill. The bill acceptor was programmed to give a time duration of hours to be consumed corresponding to the amount of bill inserted in the device. The project was installed at barangay Bulua Cagayan de Oro City for testing and evaluation. Evaluation results show that the proposed automated lights sport basketball court yielded positive affirmation as evidenced by high mean ratings on pre-established evaluation parameters.

Keywords: Barangay facility, Lighting system, Automatic Lighting, Prepaid Electricity, Rental System

I. INTRODUCTION

Technological evolution is widely visible nowadays. It can be seen through the different machines and devices that were used from the past to the present. The increasing sophistication of technology from the steam engine and discovery of electricity to telecommunications, internet and biotechnology can be seen as an evolutionary pattern [1] .Technologies share common ancestry and combine, morph and combine again, to create further technologies Technology evolves much as a coral reef builds itself from activities of small organisms [2]. One of these technologies is the vending machine. Vending machines have different types depending on their purposes. Another example of technological innovation that gives satisfaction and convenience to the users was the invention of the remote control for the TV sets, washing machines, refrigerators, computers and a lot more. This invention somehow gives comfort and convenience to everyone. One example of innovation that exemplifies comfort and convenience was the study about the development of an automated lighting system. Automation is today's fact, where things are being controlled automatically, usually the basic task of turning ON/OFF certain devices and beyond, either remotely or in close proximity[3]. Many players during their games at the gymnasium in a barangay need lighting or illumination. Most of the time during their games, the players have to wait for the in-charge of the gymnasium and it turns out that most of their times were wasted in waiting for the in-charge than in playing. The Automated Lighting Rental System for Barangay Facility seeks to answer the problem for the players in using the gymnasium lighting facility in a barangay. It uses an automatic system where the users have to insert a paper bill amounting to Three hundred pesos for one hour of use. It is comparable to a prepaid electricity system where the users have to pay in advance. The idea of paying in advance is not new. Coin- operated meters have been around since 1901, and they remained common in the United Kingdom until the mid-1980's [4]. TheArduino Mega 2560 was utilized that accepts the program and interfaces with the thermal printer for the receipt, LCD display showing the time consumed and the amount of the paper bill inserted, a buzzer that serves as a warning if the remaining time left is one minute and buzzes again if the remaining time left is 40 seconds. The Relay controls the circuit breaker where in the supply for the lighting was connected. The developed Automated Lighting Rental System for Barangay Facility accepts paper bill denomination such as twenty peso paper bill, fifty peso bill, one hundred pesos bill, five hundred and one thousand pesos bill. The bill acceptor detects the frequency value of the money through the ultra violet ray sensor which is being feed to the microcontroller. The present invention relates to bill acceptors and, more particularly, to such a bill acceptor, which uses infrared light to fetch the image of inks of the bill to be examined and ultraviolet light to scan fluorescent fibers of the bill, enabling the user to verify the authenticity of the bill accurately."[5].

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A. Specifically the study aims to

1) To design an automated light rental system for common barangay facilities.
2) To develop an automated light rental system for common barangay facilities.
3) To evaluate the acceptability of automated light rental system for common barangay facilities.

The study entitled Automated Lighting Rental System for Common Barangay Facilities sought to address the issues encountered by some users regarding the need of lights during their games in barangay Bulua, Cagayan de Oro City. The study covers the design, development and evaluation of automated light rental system for common barangay facilities. The developed device can be installed in any basketball court or gymnasium. Likewise, the developed device can provide duration of time based on the value of paper bill that was inserted in the bill acceptor and displayed in the LCD display. Receipt was immediately printed accordingly to their time based on the amount of the paper bill.

II. METHODOLOGY

The core concern of this study focuses in design, development, and evaluation of the automated lighting rental system in barangay. To make this study possible, a crucial process of identifying problem is needed to deal with effective solution. Further investigation, understanding and information are the key in finding solutions to address the specific problem and synthesize it to some useful input to substantiate the study application.

A. Process Flow Chart

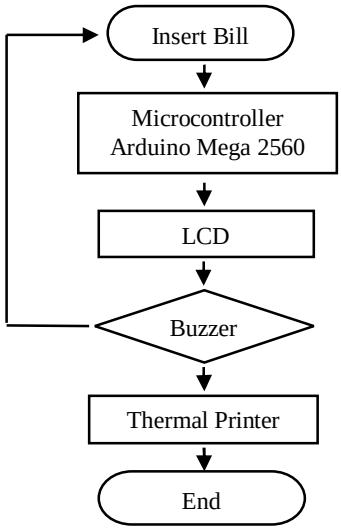


Fig.1 A Flow Chart of the Automated Lighting Rental System

After the bill was inserted at the bill acceptor, it sends a signal to the microcontroller Arduino Mega 2560 which triggers the LCD to display the amount inserted and the corresponding time. The paper bill inserted was sensed by ultraviolet sensor of the bill acceptor which accepts only Philippine currency. Figure 2 shows the code snippet used in the thermal printer.

```
Thermal.print("     BULUA BASKETBALL COURT");
Thermal.write(10);
delay(1000);
Thermal.write(27);
Thermal.write(32);
Thermal.write(zero);
Thermal.print("   Bulua, Cagayan de Oro City");
Thermal.write(10);
Thermal.write(10);
Thermal.write(10);
Thermal.print("Cash: ");
Thermal.print(Total_Money);
Thermal.print(" Php");
Thermal.write(10);
Thermal.print("Total Time: ");
Thermal.print(hour);
Thermal.print(":");
Thermal.print(minutes);
Thermal.print(":");
Thermal.print(seconds);
Thermal.write(10);
Thermal.write(10);
Thermal.write(10);
delay(1000);
Thermal.println("          THANK YOU!!!");
Thermal.write(10);
Thermal.write(10);
Thermal.write(10);
Thermal.println("");
```

Fig. 2 Code snippet of the thermal printer

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Figure 3 shows the code snippet used in the bill acceptor. The buzzer produced an audio output for four consecutive times, first if the remaining time is 1 minute left the buzzer will beep for one second duration, second buzz if the remaining time is at 40 seconds for one second duration, third buzz if the remaining time is 20 seconds for a second duration and lastly the buzzer will produce a continuous beeping if the remaining time is only 5 seconds informing the users that their time is already done. The receipt is then printed out showing the time consumed and the corresponding amount. Also indicated in the receipt is the location where the device was installed.

```
Total_Money = money*5;
if (Total_Money>=300){ //dapat greater or equal sa minimum value
    flag = 1;
    money=0;
    x=1;
    while (x==1){
    digitalWrite(Relay, HIGH);
    do{
      lcd.clear();
      hour = remaining_time/3600;
      minutes = (remaining_time-((3600)*hour))/60;
      seconds = (remaining_time-(3600*hour)-(60*minutes));
      lcd.setCursor(3,0);
      lcd.print("Remaining time");
      lcd.setCursor(5, 1);
      lcd.print(hour);
      lcd.print(":");
      lcd.print(minutes);
      lcd.print(":");
      lcd.print(seconds);
      //Serial.println(remaining_time);
      //Serial.print(" Seconds");
      //lcd.setCursor(3,2);
      //lcd.print("Seconds");
      delay(1080);
      remaining_time = remaining_time - 1;
      if (remaining_time <= 60){
```

Fig. 3 Code snippet of the bill acceptor

B. System Circuit Diagram

The Arduino Mega 2560 is a microcontroller board based on the Arduino mega 2560. It has 54 digital input /output pins, 16 analog inputs, 4 UART, a 16MHz crystal oscillator, a USB connection, a power jack and a reset button. The Arduino Mega was supplied with 12 volts dc with 3amperes current rating. Figure 4 shows the circuit diagram of the Automated Lighting Rental System.

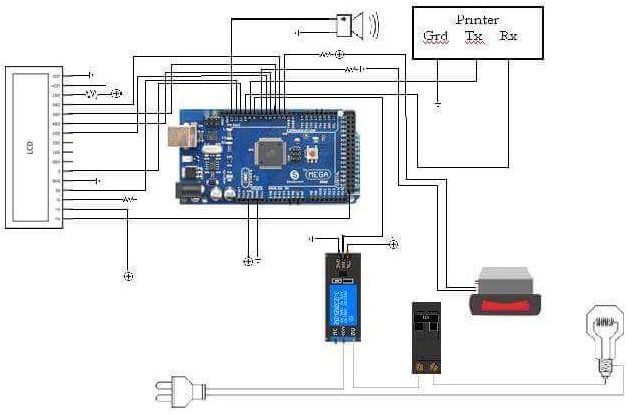


Fig. 4 Complete Circuit Diagram of the Device

Pin1of the LCD is connected to the ground while its pin2 is connected to the Vcc. LCD's pin number 3 is connected to the potentiometer for the adjustment of the contrast of the display, pin 4 is connected to the input pin of the microcontroller, pin 5 is connected into the ground, pin 6 is connected into the input pin 11 of the microcontroller, pin 11 is connected into the input pin 6 of microcontroller, pin 12 is connected the input pin 5 of the microcontroller, pin 13 is connected into the input pin 4 of the microcontroller, and pin 14 is connected into the input pin 3 of the microcontroller, pin 15 connected into the positive resistor, and last pin 16 is connected into the ground of the microcontroller. The buzzer which has two pins, one of them is connected to the input pin 13 of the microcontroller and the other pin is connected to the ground. The thermal printer has three pins. The TX pin is connected to the input pin 9 of the Arduino while the RX pin is connected to the input pin 10 of the Arduino while the ground pin is connected to the common ground. The relay controls the switching on and switching off of the lighting system where its three input

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pins is connected to the input pin 8 of the microcontroller, the other pin is connected to the Vcc and last is the ground pin respectively. The output pin of the relay is a normally closed and its common connection is connected to the AC circuit breaker with a shunt connected AC plug. The device is capable to carry a load of up to 2000 watts. The bill acceptor which accepts Philippine currency ranging from 20 peso bill up to 1000 peso bill and is being detected by the ultraviolet sensor connected to the pin 2 pulse pin of the microcontroller and the other is connected to the ground. The Arduino Mega was programmed to accept 300 pesos for duration of 1hour.

III.HIGHLIGHTS OF FINDINGS AND DISCUSSION/ DATA PRESENTATION

The results and finding are based on methodology in the study that are involved the design, development and evaluation of the Automated Light Rental System for Common Barangay Facilities. Figure 5 shows the actual image of the Automated Lighting Rental System.



Fig.5 Actual Image of the Automated Lighting Rental System

The prototype undergoes a series of testing and debugging before it was implemented. Testing includes the expected functionality and operability of the device .The functionality test convinces the responses the machine based on the input and control program of the device.

C. Data Gathering Standard

The survey questionnaire was used in the data gathering. The questionnaire was distributed to the selected respondents. The respondent are the barangay official, basketball player where using the basketball court and the court in-charge. Total of one hundred (100) different respondents were identified.

D. Impleentationand Evaluation

Figure 6 shows the implementation of Automated Light Rental System for Common Barangay Facilities. The prototype was displayed in Zone 10 ImpantaoBulua, Cagayan de Oro city basketball court for some trials and evaluations by the player and residence for a certain span of time also. The machine was installed in Basketball court for the players to test the prototype. The steps on how to operate the automated lighting rental system for common barangay facilities was thoroughly explained to the users and was demonstrated methodically. Remember that the programmed is set to have a total of (₱ 300.00) minimum before you can use the lighting system. By the moment you'll inserted the money bill, it will process the entire system. When you want to set a (₱ 300.00) with an hour duartion, you are now to use the lighting system. When it's done, the printer will produce areceipt that displays the total amount that you inserted equivalent to the light duration. Figure 6 shows the actual image of the receipt after it was printed. The receipt shows the location of the device, the amount and the total time consumption.

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Fig. 6 Actual Image during the Implementation



Fig. 6 Actual image of the receipt from the thermal printer

The Automated Lighting Rental System for Common Barangay Facilities in basketball court was evaluated using statistical survey, which measures acceptability, functionality, aesthetics, safety and operability of the prototype. Survey instrument was being used and was conducted to the 100 different respondents in the locality of barangay Bulua. The respondents include different players, referees, and the residents in the area, the local barangay officials and some visitors in the locality. The prototype was evaluated using the 5 point Likert scale where 5 being the highest and 1 being the lowest. Figure 7shows the graphical summary presentation of the evaluation of the Automated Lighting Rental System for Common Barangay Facilities.

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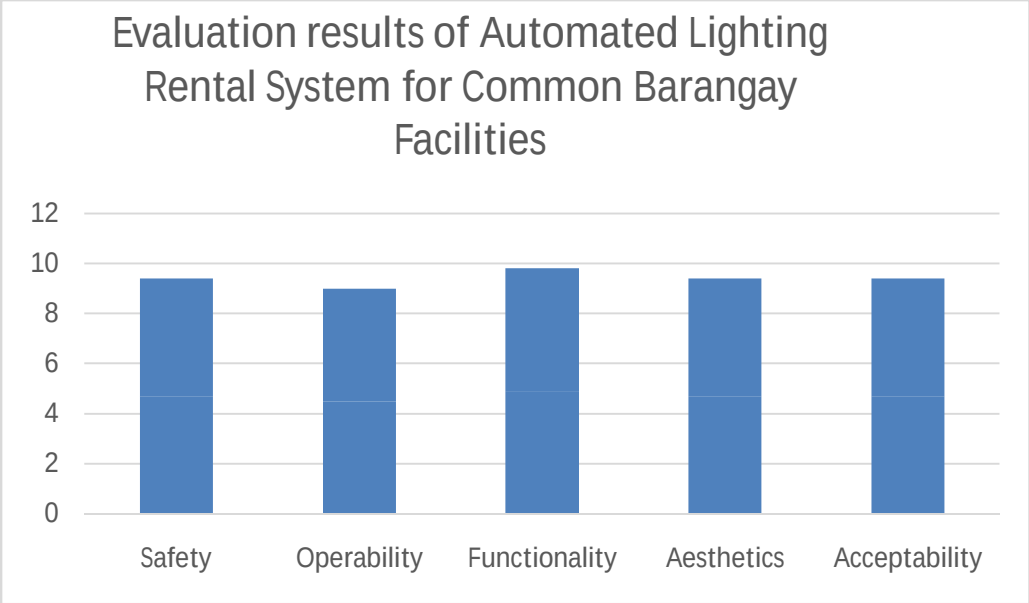


Fig. 7 Mean Responses of Automated Lighting Rental System

The overall mean for safety is 4.7 while overall mean for its operability is 4.5. The overall mean for its functionality is 4.9 while the overall mean for its aesthetics and acceptability is 4.7.The overall mean result implies that the Automated Lighting Rental System is acceptable in terms of its safety, functionality, operability, and aesthetics.

IV. CONCLUSIONS

The study conducted has yielded some conclusions based on the findings that were summarized in the previous section. It is now possible to derive several conclusions based on the objectives presented in the first chapter. These conclusions are the following:

A. Most of the people today use's bill acceptor devices; the device itself is operated by an Arduino Mega operating system which is now common to the users.

B. Upon evaluation, the result says that it is an advantage for them to operate the device that is why it can be easily familiarized.

C. All the participants and users were satisfied with the device and its output. It is also recommendable to others who are in need of its services and those who are in avoiding wasting of time.

D. The device is more convenient and efficient to use

E. The device is user-friendly. Most of the users of the survey agreed that it is advantageous because it saves them the time.

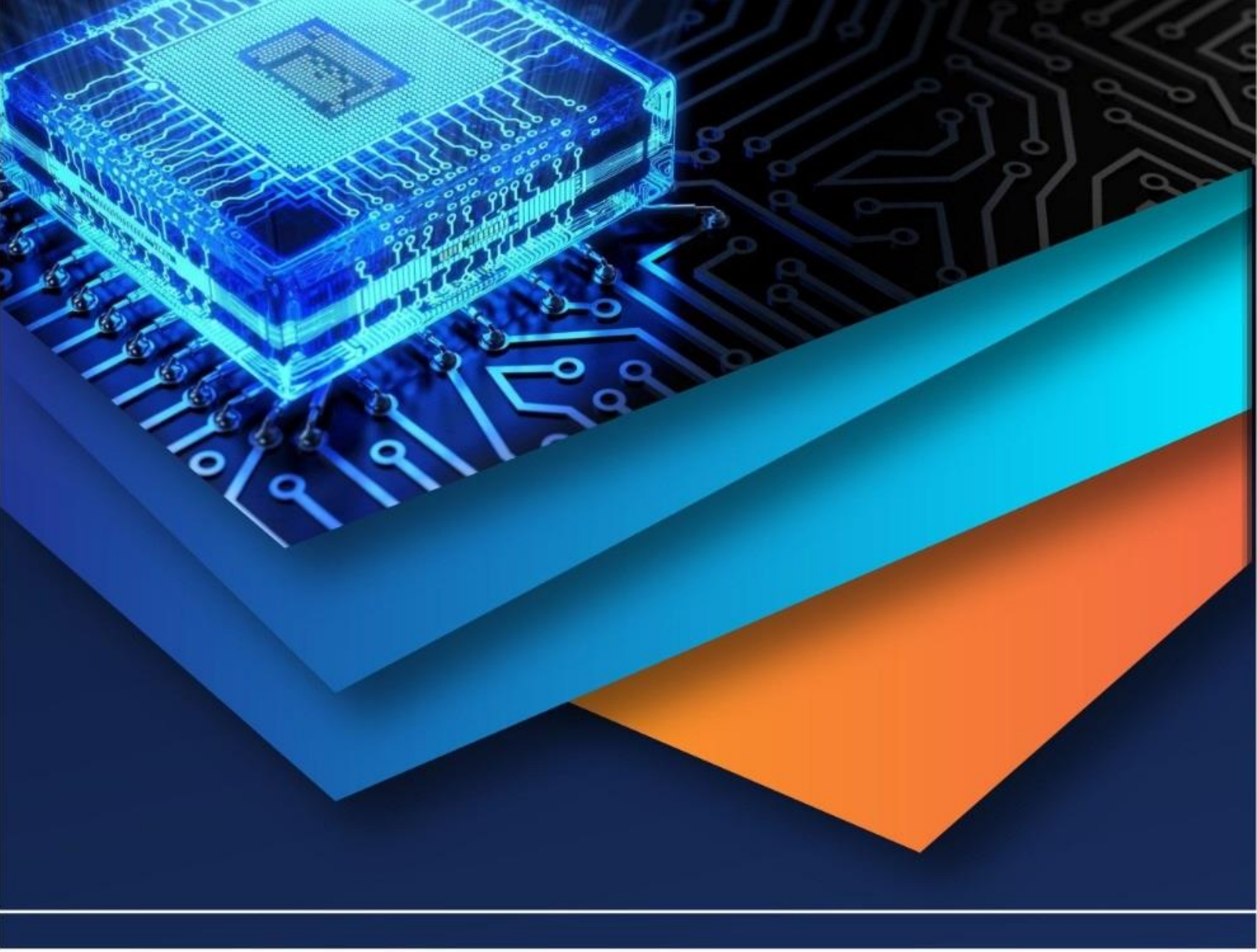
V. ACNOWLEDGEMENT

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