ISBN: 978-623-91160-2-6

UTILIZATION OF ARDUINO UNO R3 AND RTC DS3231 AS AUTOMATIC SCHOOL BELL

1st Tria Hadi Kusmanto
Information Study Program, Faculty of Engineering and Computer Science (Universitas Indraprasta PGRI Jakarta)
Jakarta, Indonesia

2nd Bramantara Yudha
Information Study Program, Faculty of Engineering and Computer Science (Universitas Indraprasta PGRI Jakarta)
Jakarta, Indonesia

3rd Adhi Susano
Information Study Program, Faculty of Engineering and Computer Science (Universitas Indraprasta PGRI Jakarta)
Jakarta, Indonesia

***Abstract*—To determine the time of activity in school, the school bell is needed as a tool or means that gives the code of Exchange sound of that time. The digital school bell-based Arduino or microcontroller has a lesson hour scheduling capability. Utilizing Arduino Uno R3 and RTC DS3231 into an automatic school bell is a destination in the development of a button-based electric school bell whose use is still in the category of manual. Hopefully the school Bell System can automatically help the school picket teachers in carrying out their duties. The method used in research is research and development, which is analysing the needs and designing and building the system. The results of the research conducted are automatic Bell devices using Arduino Uno R3 as the driver and schedule system of the school bell as well as RTC DS3231 as the time control on the system.**

Keywords*—Automatic Bell School, Arduino Uno R3, DS3231

I. INTRODUCTION

Human character that has ideas and innovations in the development of a country can be formed and obtained through education that is the principle for the advancement of the nation. Promoting education in the vision of the country's progress and educate the nation is one of the efforts to improve the state of Indonesia. The state budget is allocated for the implementation of 20% education is one of the descriptions of the seriousness in prioritizing education in Indonesia.

The process of education is not separated from the role of the school that serves as a means of teaching learning activities. There are several components in the school as a part of the education process in teaching and learning. One of the important components to be aware of is the time discipline of learning teaching teachers and students. The discipline of teaching time is always marked by the schedule of change in learning time. Time in teaching change is known by the Sound of school bells. Teachers and students prepare to continue the process of learning to teach the next subject or school break time, it is done based on the prescribed scheduling, and time changing information in the school identical Marked with the sound of the bell rang, so the school bell becomes an effective medium in providing schedule turnover information in schools.

School bells are usually in a bell-shaped design which is a preliminary technology to implement time-changing information on teaching and learning at school. Ringing the bell is done manually by hitting or swinging the pendulum that is in the bell, it is done by a picket teacher in charge of keeping the learning time in the school become regular.

As the development of technology, the electric-based school bell has replaced the pendulum school bells or o'clock. Iron bells whose way of use is to hit it and the buzzer bell used by swinging the pendulum resulting in a sound has been replaced with an electric-based school bell is a school-based bell button for Unmute.

Ease in everyday life is widely given from the development of science and technology. Where everything that is widely applied to science and technology with machines or electronics, so that human work can be done easily without having to waste power and can shorten the time. Various household tools to office work tools using electronic devices so that human work is much easier. As an example of the utilization of the Arduino Uno microcontroller which is utilized as an

automatic school bell controller. With this system can make it easier to ring the school bell when the time of study begins, rest time and time of school home. While for teachers who are tasked with picket to ring the school bell will feel the hassle to always ring the school bell that feels less efficient time and energy. These problems can be addressed with the automatic school bell Controller using the school Bell activation system automatically using the Arduino Uno microcontroller. One of the facilities owned by this automatic school bell is the launch schedule system of the school bell, by inputting the school bell schedule to the Arduino Uno microcontroller, the school bell automatically will be activated according to the schedule of the school bell that has been programmed, so the teacher in charge of the picket to ring the school bell no longer need to always ring the school bell manually.

Based on observations, institutions such as schools and boarding school now still utilize the bell as a sign or time reminder tool. According to the results of interviews with the school, the electric buzzer used how it works is still a switch operated by the school picket teacher. The system used manually has many weaknesses including delays or negligence in carrying out tasks. Of the several incidents of such delays led to the subject of the lesson time that led to the effectiveness of teaching and learning activities to be reduced. Furthermore, with frequent delays resulted in the school's indiscipline. When entering the schedule for gymnastics on Friday, the operator has difficulty in operating the audio device because the audio player has not been integrated directly with the sound amplifier, so that additional cables need to be removed and installed Back when it will be used.

With the tool clock indicator that works automatically that is also integrated with the audio player, it is expected that learning activities at school will be more efficient because of the delay in providing information hour the commencement of teaching and learning activities can be eliminated.

A. Problem formulation

Based on the background that has been elaborated, the problems in this study are:

1. How to design a school bell system that can be active or ring a school bell automatically using Arduino Uno microcontroller?
2. How is the implementation process automatic school bell?

B. Problem limits

In the design and manufacture of this tool, there are some restrictions on problems, such as:

1. This system uses Arduino UNO microcontroller as the command data manager.
2. The tool design is still limited to prototypes.
3. Modul RTC used is type DS3231.
4. Serves as a schedule change

This system uses a power supply from PLN so that if there is a power outage, then the system and circuit can not function. Based on the advancement of Electrical and electronic technology, the school bell Technology has evolved into an automated school bell-based technology This is evident from the research that researchers have done before. Some of them are design-based automated school bells

An AVR ATMEGA8 microcontroller built by (I Gusti Agung Putu Raka Agung and Friend, 2011) The study resulted in a school bell equipped with a 4x4 keypad and a series of 7 segments as a user interface. While processing data using microcontroller ATMEGA8 which is accompanied by the module RTC (Real Time Clock). From the results of this research the relay can connect automatically with the power Bell with the controller of the microcontroller ATMEGA8.

In subsequent studies (Irwanto, Subandi, & Santoso, 2013) resulted in a school bell with a digital clock device design equipped with a music bell as its alarmed output. The bell will sound in accordance with the specified time, and will die if on holidays. This tool consists of the ATMega8 microcontroller as the main controller, the RTC DS1307 As a time store, LCD as a media viewer, IC UM3483 as a music bell, and keypad to set the desired time.

While the school bell performed by (Subianto, 2015) is an automatic Bell system using a Raspberry Pi. The bell has the ability to control the electronic network so that it can produce sound as a sign of time in the learning and can control the sound source of AC buzzer, DC buzzer, speaker and has a more Compared to using a PC.

Unlike the research conducted (Utomo et al., 2016), the school bell was built using Arduino Uno microcontroller as the process and coupled with some additional components such as LCD 16x2, keypad/push Button, RTC module DS1307 and SD card shield. The way to input the school bell schedule is to insert the school Bell Schedule program with the Arduino Uno microcontroller. In this auto school Bell Schedule program there are 2 modes: Main schedule mode and exam schedule mode. Where in each mode has a schedule of different school bells. For the main schedule mode is the daily school tuition schedule and the exam Schedule mode is a lesson schedule during school exams. And the way this automatic school bell works is by

ISBN: 978-623-91160-2-6

specifying the schedule mode to be used first, after which the school bell will work automatically to activate or unmute the school bell according to the school Bell schedule mode that has been Selected.

For the research conducted by (Nuryani, Tosida, & Karlitasari, 2016) that the school bell built is a bell activation automation model that is applied using an application Installed on a computer and the sound will be distributed using the help of the loudspeaker. The school Bell app is automated in this research time equipped with SMS Gateway feature. This feature Allows the user to activate the buzzer remotely.

Research that has been done by (Satria and friends. 2017) is a design build system of scheduling of Arduino Uno-based school bell with web-based interface using Ethernet integrated Web server with microcontroller Arduino Uno as a data processor and RTC (Real Time Clock) as the timer. A series of systems built using the Arduino Uno microcontroller module, RTC (Real Time Clock), Ethernet Shield, Relay and electric buzzer. The study resulted in a school bell scheduling system with a Web browser-based interface using the Ethernet Shield as a Web server.

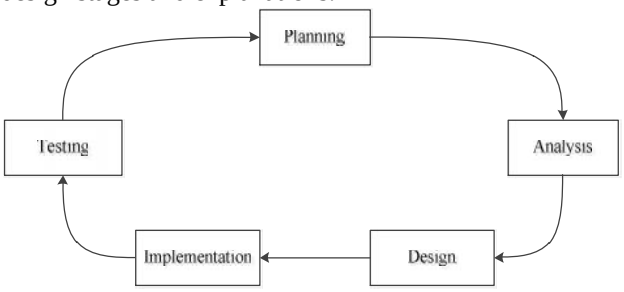
II. LIBRARY OVERVIEW

The school time allocation arrangement according to (BNSP, 2006) that the time allocation setting for each subject contained in the odd and even semester systems within one school year can be done flexibly to the number of fixed study loads. It is possible to add a maximum of four hours of learning per week as a whole. The use of additional learning hours consider the need for learners to achieve competence, in addition to being utilized for other subjects that are considered important and not found in the curriculum structure. The difference in the package system and the system SKS on average 1 credits equals 2 hours of learning time on the package system.

III. METHOD

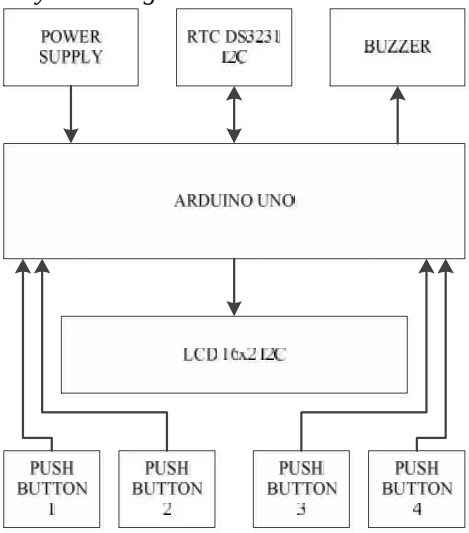
A. Methodology Research

This research uses research and development methods that is analysis of the Bell System problems at SMK Mandiri Bojonggede School and designed the development of a school bell system that is analog button into an automatic bell that can sound on the schedule has been determined. Development of the school bell System that is generally done, namely analysis of system needs then design a system to be built, after which the next stage is the creation of tools and carried out a test tool with the system applied. Below are models of system design stages and explanations.



Picture 1. Model Research and Development

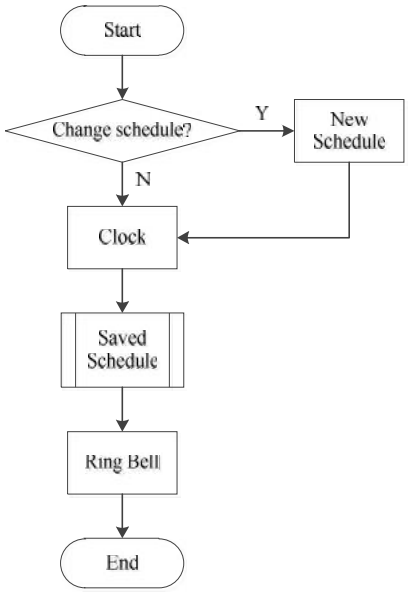
B. Block System Diagrams



Picture 2. School bell Diagram Block using Arduino

In Picture 2, there are two input parts, namely power supply and RTC DS3231. The Power supply serves as the voltage giver required by the Arduino and other devices. RTC DS3231 function gives the input of the current time stored in it and serves as a timekeeping. A Push button is a tool that serves as a time input into the Arduino and as a medium for the timer in the RTC to make it easier for users. Time is displayed by the Arduino through the LCD 16x2 as the Arduino Bell System interface. When it is time the bell rings, the LCD displays a message and the sound is ejected through the buzzer as the automatic bell system sound output.

ISBN: 978-623-91160-2-6



Picture 3. Automatic Bell System flowchart

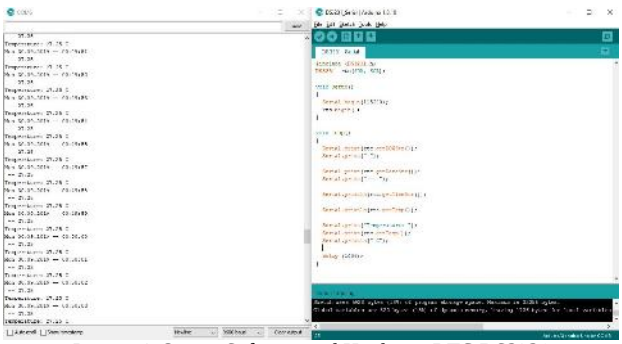
The first stage of automatic use of the Bell System is displaying options for school schedule arrangement. If you want to change the schedule, users can press the first button instead of the third button. When choosing to change the schedule, the user must enter a course schedule and schedule a break. Entering the schedule into the system is gradually starting from Monday with the schedule on Monday. Then proceed for the next day until Saturday. Use the first or second button to select the subject that will be inserted into the system after selecting the subject, then use the fourth button to save the subject on that day. Do enter the schedule until done then press the third button to save the whole and exit the schedule input view. The LCD screen will display the schedule information to be addressed. If the clock shows the time according to the schedule, the system will display the first and subsequent schedules. As long as the device is ON "ON", then the system will work next according to the schedule that has been entered. When the device is "OFF" then it can run back after turn on and give the option not to change the schedule because the already inserted schedule is saved into the system.

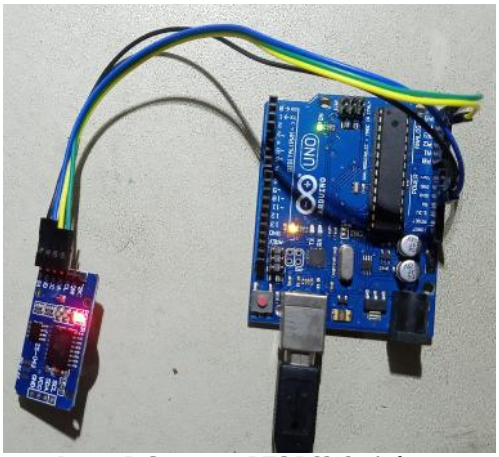
IV. RESULTS AND DISCUSSION

A. RTC DS3231 Module Function

In this paper, the RTC DS3231 as the module of the current time. The following program code shows the RTC module task. The module function RTC is a real time saving now that has been set up with the program code and keeps the time or schedule saved into the system. The module works via I2C (Wire library) on the A4 pin for the SDA and A5 for the SCL. Descriptions of inputs and outputs and module values are found in the print series.

```
#include <DS3231.h>
DS3231  rtc(SDA, SCL);
void setup()
{
 Serial.begin(115200);
 rtc.begin();
}
void loop()
{
 Serial.print(rtc.getDOWStr());
 Serial.print(" ");
 Serial.print(rtc.getDateStr());
 Serial.print(" -- ");
 Serial.println(rtc.getTimeStr());
 Serial.println(rtc.getTemp());
 Serial.print("Temperature: ");
 Serial.print(rtc.getTemp());
 Serial.println(" C");
 delay (1000);
}
```


Picture 4. Output Software and Hardware RTC DS3231


Picture 5. Connection RTC DS3231 Arduino

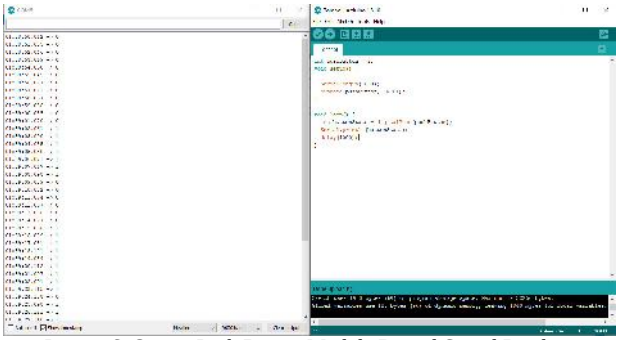
B. Push Button Module Function

The next module is a push button that serves as an input button that reads the digital signal. In the automatic Bell System, the push button plays a custom keypad used as a tool for entering and arranging schedules into the system. There are 4 push buttons whose working system is different. The first button that works as the answer

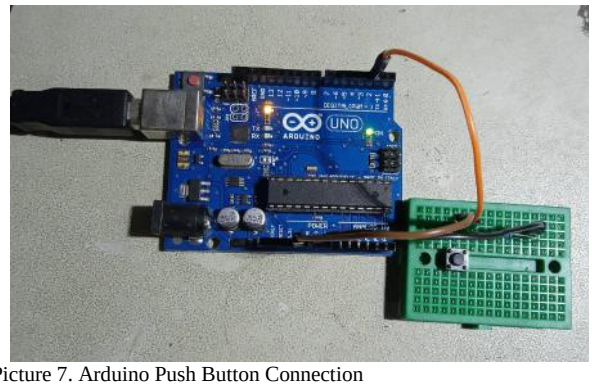
ISBN: 978-623-91160-2-6

button "yes" and as a backward/left direction. The second button works as a forward/right direction. The third button works as an Exit button. The fourth button works as a "no" answer button and as a Save button. The button works as an input that reads the "HIGH" or "1" connection if the button is pressed (Close) and "LOW" or "0" if the button is released (Open). The button module description is on skets that reads digital signal inputs.

```
int pushButton = 2;
void setup() {
  Serial.begin(9600);
  pinMode(pushButton, INPUT);
}
void loop() {
  int buttonState = digitalRead(pushButton);
  Serial.println(buttonState);
  delay(1000);
}
```



Picture 6. Output Push Button Module Digital Signal Reading



Picture 7. Arduino Push Button Connection

In the system, push button works as an input tool to set the schedule. The four buttons each have different commands.

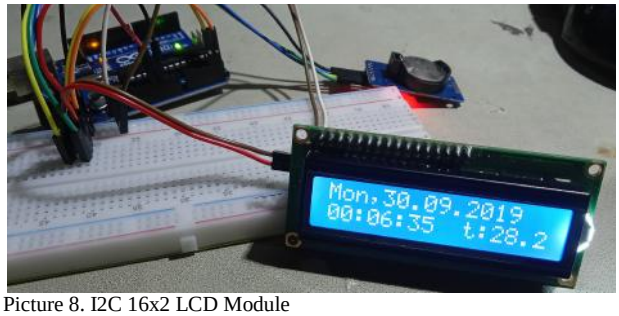
```
#include <Keypad.h>
int b1 = A0;
int b2 = A1;
int b3 = A2;
int b4 = A3;
int bS1 = 0;
int bS2 = 0;
int bS3 = 0;
int bS4 = 0;
void setup()  {
pinMode(b1, INPUT);
  pinMode(b2, INPUT);
  pinMode(b3, INPUT);
  pinMode(b4, INPUT);
}
void loop() {
   bS1 = digitalRead(b1);
   bS2 = digitalRead(b2);
   bS3 = digitalRead(b3);
   bS4 = digitalRead(b4);
if(bS1==LOW){
        pos=20;
        DateTime now =rtc.now();
        prevTime=now.minute();
        prevHour=now.hour();
        Serial.println(prevHour);
        Serial.println(prevTime);
        Serial.println(EEPROM.read(4));
        lcd.clear();}
}
```

C. LCD 16x2 I2C Module Function

Another module on the automatic Bell System is the LCD. The LCD serves as a digital output and as an interface of the built-in system. The LCD used has a size of 16 columns and 2 lines called LCD 16x2. The LCD module reads as a Liquid Crystal I2C where the pins are used less than with no I2C. LCD function Description Displays the current date and time and indicates the temperature of the device used.

```
#include <DS3231.h>
#include <LiquidCrystal_I2C.h>
#include <Wire.h>
DS3231  rtc(SDA, SCL);
LiquidCrystal_I2C lcd(0x27, 2, 1, 0, 4, 5, 6, 7, 3,
POSITIVE);
void setup()
{
  Serial.begin(9600);
  rtc.begin();
  lcd.begin(16, 2);
  lcd.setBacklight(255);
}
void loop()
{
  Serial.print(rtc.getDOWStr(1));
  Serial.print(" ");
  Serial.print(rtc.getDateStr());
  Serial.print(" -- ");
  Serial.println(rtc.getTimeStr());
  Serial.print(" -- ");
  Serial.println(rtc.getTemp());
  lcd.setCursor(00, 00);
```

```
  lcd.print(rtc.getDOWStr(1));
  lcd.setCursor(3, 00);
  lcd.print(",");
  lcd.setCursor(4, 00);
  lcd.print(rtc.getDateStr());
  lcd.setCursor(00, 1);
  lcd.print(rtc.getTimeStr());
  lcd.setCursor(9, 1);
  lcd.print("t:");
  lcd.setCursor(10, 1);
  lcd.print(rtc.getTemp());
  lcd.print("C");
  Serial.print("Temperature: ");
  Serial.print(rtc.getTemp());
  Serial.println(" C");
  delay (1000);
}
```

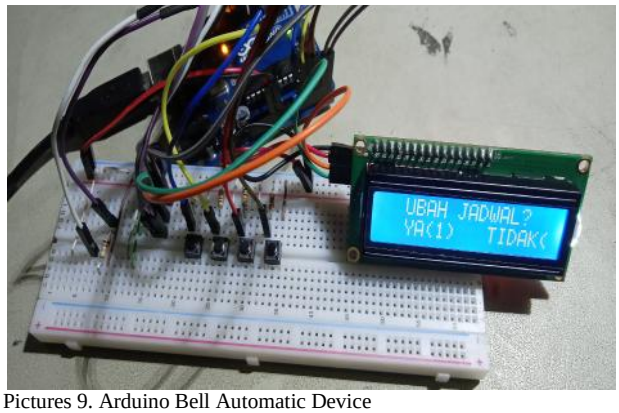


Picture 8. I2C 16x2 LCD Module

With the LCD that serves as a system interface, the user can arrange the schedule by paying attention to the LCD for the time entered according to the school schedule.

D. Automatic Bell Arduino

The automatic bell device is connected to a power supply as an energy source. Then the LCD will display the name of the system. After that the question is displayed for schedule changes. The user can press the first button to change the schedule or press the fourth key to use a schedule system that has been saved in the system. When the user presses the first key, the user must enter the start and end time of the system. Then determine the schedule of the lessons entered according to the day from Monday to Saturday. Includes daily lesson schedule using push button. Save the settings every day by pressing the fourth button. After all days have been saved schedules, press the third button to exit the schedule change view and the LCD screen will display the start of the active schedule.



Pictures 9. Arduino Bell Automatic Device

V. CONCLUSION

Based on the results of the utilization of Arduino Uno as an automatic school bell, it is obtained by the presence of this automatic school bell device, then the teacher who is responsible for sounding/activating the school bell, no longer sounds the school bell Manually, so that it can relieve the work of the picket teacher in charge/activate the school bell. Ease in sounding/activating the school bell, as the school bell schedule has been inserted into the automatic school bell. So the school bell will automatically be read according to the schedule of the school bell that has been entered into the automatic school bell.

For further development, the authors provide very useful advice and can help the improvement of the school bell for the future, namely by adding a module to harden the sound so that the sound of the bell is more audible. The school bell interface looks less wide because it uses only the 16x2 LCD.

THANK YOU NOTE

Thank you for being uncounted to Allah SWT so that this paper can be solved. Thanks to the research team who have worked together until the end of the study.

REFERENCES

[1] I Gusti Agung Putu Raka Agung and friends. 2011. *Rancang Bangun Bel Sekolah Otomatis Berbasis Mikrokontroler AVR ATMEGA8.* Teknologi Elektro. Vol. 10. No.2. pp. 11-17.

[2] Ghora, Putra Pratama. 2011. *Rancang Bangun Jam Digital Menggunakan RTC Dengan Alarm Berbasis Mikrokontroler*. Surabaya: Universitas Pembangunan Nasional "Veteran".

[3] Mahfud, Tri Gunawan. 2011. *Perencanaan dan Pembuatan Bel Tanda Pergantian Mata Pelajaran Di Sekolah Berbasis ATMEGA 16*. Surakarta: Universitas Muhammadiyah Surakarta.

[4] Muhammad, Syahwil. 2014. *Panduan Mudah Simulasi & Praktek Mikrokontroler Arduino*. Yogyakarta: Penerbit Andi.

ISBN: 978-623-91160-2-6

[5] Irwanto, R. E., Subandi, & Santoso, G. 2013. *Bel Sekolah Otomatis Berbasis Mikrokontroler Atmega8*. Jurnal Elekrikal, 1, 13–18.
[6] Subianto, M. 2015. *Sistem Bel Otomatis Terprogram Berbasis Raspberry Pi.* SMATIKA Jurnal, 1(Juni), 05–12.
[7] Utomo, H. T., Winardi, S., Kristiana, W. A. 2016. *Rancang Bangun Bel Sekolah Otomatis Berbasis Arduino Uno*. Fakultas Ilmu Komputer - Universitas Narotama Surabaya, 1, 1–8.
[8] Nuryani, Y., Tosida, E. T., & Karlitasari, L. 2016. *Aplikasi Bel Sekolah Otomatis Berbasis SMS Gateway*. Prodi Ilmu Komputer FMIPA Universitas Pakuan, 1(Juni), 1–7.
[9] BNSP. 2006. *Panduan Penyusunan Kurikulum Tingkat Satuan Pendidikan Jenjang PendidikanDasar dan Menengah Badan Standar Nasional Pendidikan 2006*, 1–23. Retrieved from http://bsnp-indonesia.org/id/wp-content/uploads/kompetensi/Panduan_Umum_KTSP.pdf.
[10] Satria D., Yeni Y., Maulinda. 2017. *Rancang Bangun Sistem Penjadwalan Bel Sekolah Berbasis Arduino Uno dengan Antarmuka Berbasis Web Menggunakan Ethernet Web Server.* Serambi Engineering. Vol. 2. No. 3. pp. 141-147.