

# Differential Counter Design with Voice Output and Storage on SD Card

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**Abstract:** Differential counter is a tool used to calculate the type of white blood cell. Observation of the results of white blood cell count can provide more specific information about infection and disease progression process. The main basis in calculating the type of white blood cell is the calculation using standard (standard) tools. This design is based on ATMEGA 8535 which uses 6 push buttons to represent each type of white blood cells to be counted and 1 push buttons to reduce what if there is an excess in the calculation. This module also uses ISD 2560 to store the cell sounds to be counted. It is further processed by ATMEGA 8535 microcontroller and displayed on lcd and can be stored on SD Card. The purpose of this research is to design the Differential Counter Equipped with Sound Output and Storage in SD Card. The research design used is pure experimental research that is independent variable is white blood cell type. The phases used are circuit design, and test.

**Keywords:** Differential Counter, Blood Cell White, ISD 2560, SD Card

## 1. Introduction

Differential Counter is a tool used to determine the number of different types of leukocytes. There are five types of leukocytes, each of which has a special function against pathogens. The cells are stem neutrophils (stab), neutrophil segment, lymphocytes, monocytes, eosinophils, and basophils. Leukocyte count results provide more specific information about infection and disease processes. Calculating the leukocyte type only shows the relative amount of each cell type. To obtain the absolute amount of each cell type then the relative value (%) is multiplied by the total leukocyte count (cell /  $\mu$ l).

Differential Counter in the laboratory room in the data collection is still found excess calculation of leukocyte cell type, so the medical personnel should note the excess of cell types that have been counted on a sheet of paper, because if not recorded will affect the process of diagnosis of a disease. Methods of calculating the type of white blood cell (leukocytes) used today are still manually that is hitting and writing on a paper manually, there are also some lab officers using Differential Counter tool, but there are still some complaints such as when using the tool is still not sure of the type the already readable cell is already counted. Another complaint is that after the reading and counting process still allows an error while copying the calculation results from the tool to the report form. Previous research has made Differential tool counter with sound indicator, there are still shortcomings of the voice indicator that is too long so disturb the operator concentration when using the tool.

From these problems then the author will change to the microcontroller system. This tool uses the keys in the count, each key represents as the count of the number of each leukocyte cell. The source of this tool is the battery. The completion of the sound output of each cell type name to be calculated in the duration is shorter than previous research and data storage on the SD Card.

Seen from the chronology above, the researchers designed the tool related to the problem with the title "Design

Differential Counter equipped with sound output and storage on SD Card". In addition, this tool will also be used as a learning module in the course of laboratory tools and bias is used to perform calculations in the health laboratory.

## 2. Research Methods

To answer the research objectives, the research design used was to use pre experimental method with the type of after-study design because the final result of measurement tool compared with the control group. While the design is through the stages as follows: circuit design and circuit testing.

When the start of the microcontroller initializes the program, then the calculation of the cell will then output the sound of each cell type that is calculated. When a calculation error occurs, press the -1 button. When finished counting, the results are displayed on the LCD.

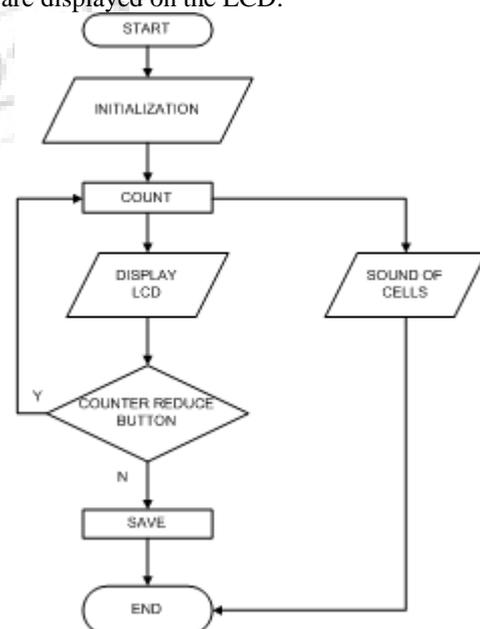


Figure 1: Flow Chart System

### 3. Result and Discussion



**Figure 2:** Panel The Modul

When the switch is in ON condition then all circuit get voltage supply from battery. Thus the minimum system and the sound module gets a voltage. When performing calculations, each button of the cell type is pressed, it sends the logic to call the previously recorded voice address on the ISD2560 IC according to the key pressed. Then the ISD2560 IC will emit a sound according to the button pressed through the speakers. When the total has reached 100% then can not continue the calculation and marked the buzzer sound as a momentary indicator [1][2] [3].



**Figure 3:** Display Result Sample 1

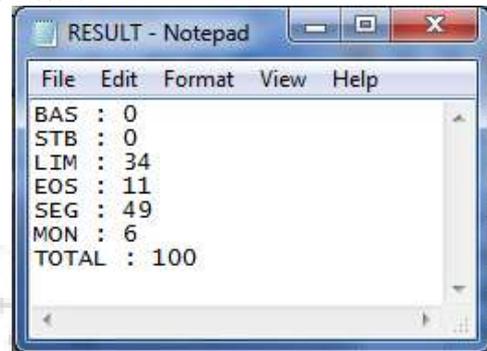
JENIS PEMERIKSAAN	HASIL	NILAI BUKUAN	SATUAN
<b>HEMATOLOGI</b>			
<b>HEMATOLOGI RUTIN</b>			
<b>Hematologi Lengkap</b>			
Hemoglobin	11.8	12.8 - 17.4	g/dL
Hematokrit	4.30	3.8 - 5.8	l/100l
Hematokrit	34.9	37 - 51	%
MCV	81.2	81 - 103	fL
MCH	27.8	27.8 - 34.8	pg
MCHC	33.2	31.0 - 37.0	g/dL
RDW	17.2	11.5 - 14.5	%
Leukosit	5.800	4.400 - 11.300	/µL
<b>Hitung Jans</b>			
→ Eosinofil	11	2-4	%
→ Basofil	0	0-1	%
→ Neutrofil Bakuang	0	3-5	%
→ Neutrofil Segmen	48	50-70	%
→ Limfosit	34	25-40	%
→ Monosit	6	2-8	%

**Figure 4:** Report Sample 1 From Laboratory

From Examination 1 Results Calculated From Differential Counter Design Module Equipped With Sound Output and storage on SD Card equal to manual calculation:

BASOFIL : 0  
 STAB : 0  
 LIMFOSIT : 34  
 EOSINOFIL : 11  
 SEGMENT : 49  
 MONOSIT : 6  
 Total : 100

SD Card Result



**Figure 5:** File On SD Card

The results stored on the SD Card are in .txt format, and can keep reading results continuously

### 4. Conclusion

Based on the results of planning, module creation, writing and data analysis can be summarized as follows:

- Sound processing circuits can be recorded and replayed according to pre-set addresses. In addition, in sound recording is suggested to condition a quiet environment and distance of the sound source with mic condenser about 1 cm in order to obtain a good recording.
- Minimum system capable of running the program so that it can perform counter up and also ordered IC ISD2560 to output the sound of each pressing of the calculated cell type button.
- The program will work properly while at a 5VDC voltage.
- Software that has been made to run in accordance with the sequence, proved the module can calculate the type of cell and make a sound according to the calculated keystrokes.

### References

- Atmel. 2006. *8-bit Microcontroller with 8K Bytes In System Programmable Flash AT Mega 8535*
- Doktertech. 2015. *Perekam Suara dengan ISD 2590*. <http://doktertech.blogspot.co.id/2010/10/perekam-suara-dengan-isd-2590.html> (Accessed September 21th 2015)
- Windbond. 2003. *ISD 2560/75/90/120*