Clusterization of Clinical Symptoms of Disease COVID-19 Using K: Means Algorithm Based on Arduino Uno and Sensor Max 30100

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Keywords: Covid-19, MAX30100, Arduino-Uno, Disease, K-Means.

Abstract: Symptoms of Covid-19 other than fever, which must be watched out by the public at this time is the condition of shortness of breath due to a decrease in oxygen levels in the blood. This condition can make a person experience respiratory problems such as shortness of breath or dyspnea which can be fatal, especially for people who can interfere with vital organs, namely the heart and oxygen levels in the body to cause death. This study designed a tool that can detect clinical symptoms of COVID-19 disease, namely shortness of breath through measuring oxygen saturation levels and heart rate for shortness of breath symptoms using the MAX30100 sensor and Arduino Uno as a controller. Tests for oxygen saturation levels and heart rate were carried out by measuring the thumb and followed by testing the accuracy of the output using the clustering technique using the K-Means Algorithm using the Rapid Miner Application. Comparison of readings of clinical symptoms of shortness of breath through oxygen saturation levels. heart rate from the output of the device compared with the use of the K-Means clustering technique showed the same results, which was 100%. Tests 1-10,19,20 showed no symptoms of covid-19 while testing 11-18 showed symptoms of covid-19.

1 INTRODUCTION

Coronaviruses are a large family of viruses that cause disease in humans and animals. In humans, it usually causes respiratory tract infections, ranging from the common cold to serious illnesses such as Middle East Respiratory Syndrome (MERS) and acute respiratory syndrome.

Severe Acute Respiratory Syndrome (SARS). A new type of coronavirus found in humans since an extraordinary event appeared in Wuhan, China, in December 2019, was later named Coronavirus Disease-2019 (COVID-19) (infectionemerging.kemkes.go.id, 2021). On March 2, 2020, for the first time, the government announced two cases of positive Covid-19 patients in Indonesia.

The spread of the Covid-19 virus has become a worldwide concern in the past year. According to data from information worldometers, as of February 26, 2021, there have been 113,516,853 cases of Covid-19 worldwide. the total number of people exposed to COVID-19 in the country reached 1,527,524 cases with a total of 41,242 cases died as of April 3, 2021 (covid19.go.id, 2021)

One of the symptoms that people have to watch out for today is Happy hypoxia, which is a decrease in oxygen levels in the blood, this condition can make a person experience respiratory problems such as shortness of breath or dyspnea which can be fatal, especially for people who can interfere with vital organs, namely the heart and lungs. oxygen levels in the body to cause death.

Symptoms of Covid-19 are divided into 3 levels, namely mild symptoms, moderate symptoms and severe symptoms as follows (PDPI,2020)

1. Not Complicated / Mild:
   1) Fever > 38^0C
   2) Cough.
   3) Sore Throat.
   4) Nasal congestion
   5) Malaise
   6). Headache
   7).Muscle Pain
2. Mild Pneumonia:
   1) Fever > 38^0C.
   2) Cough
   3) Shortness of breath, persistent cough and sore throat.
   4) Children with mild pneumonia have a cough or difficulty breathing and rapid breathing, respiratory rate: <2 months, 60x/min; 2–11 months, 50x/ minute

Ulfah, M. and Irtawaty, A.
Clusterization of Clinical Symptoms of Disease COVID-19 Using K: Means Algorithm Based on Arduino Uno and Sensor Max 30100.
DOI: 10.5220/0011843900003575
In *Proceedings of the 5th International Conference on Applied Science and Technology on Engineering Science (iCAST-ES 2022)*, pages 597-600
ISBN: 978-989-758-619-4; ISSN: 2975-8246

; 1–5 years, 40 x/min and no signs of severe pneumonia.

3. Severe pneumonia. In adult patients:
   1) Symptoms that appear include fever or suspicion of respiratory tract infection.
   2) Signs that appear are tachypnea (respiratory rate: > 30x/minute), severe respiratory distress or patient oxygen saturation <90% of the air outside.

The heart pumps blood throughout the body through the arteries, which causes the arteries to contract or in the vessels to stretch and constrict. So to measure the heart rate can be done on the arteries by using photoplethysmography. (Lukman, 2020)

The following is the classification of heart rate based on age (Arthana, 2017)

Usia (Tahun)	*Bradikardia (bpm)*	*Normal (bpm)*	*Takikardia (bpm)*
<1	<100	100-160	>160
1 – 10	<70	70-120	>120
11-17	<60	60-100	>100
>17	<60	60-100	>100

Figure 1: Classification of heart rate by age.

2 METHODS

The research apparatus included an Arduino uno, MAX30100 sensor, LCD , buzzer.
Starting at the initial state of all existing devices. then measured oxygen saturation levels and heart rate using the MAX30100 sensor. Result conditions:
1. Condition, if oxygen saturation level <95% and heart rate >100 bpm indicates shortness of breath
Then: *There are Symptoms*
2. Condition, if oxygen saturation level >95% and heart rate <100 bpm Then: *No Symptoms*
Based on the needs and implementation to help detect clinical symptoms of COVID-19 disease using Arduino uno, MAX30100 sensor.

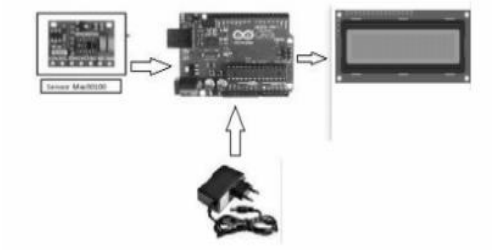

Figure 2: Block Diagram.

3 RESULTSAND DISCUSSION

In testing the tools, the results of the research were carried out on 20 people by measuring through the thumbs of the hands and in parallel with the tools on the market.

Table 1: Tool Test Results.

No	Name	Level SP02 (%)	Level Heart Rate (bpm)	LCD Display	Buzzer
1	Arjun	98	82	No symptoms	OFF
2	Aldy	98	69	No symptoms	OFF
3	Arif	96	82	No symptoms	OFF
4	Rahmat	95	80	No symptoms	OFF
5	Figo	97	84	No symptoms	OFF
6	Dea	95	84	No symptoms	OFF
7	Sri	96	83	No symptoms	OFF
8	Sigit	97	75	No symptoms	OFF
9	Winda	97	77	No symptoms	OFF
10	Ragil	96	78	No symptoms	OFF
11	Nasrul	101	105	symptoms	ON
12	Heri G.	97	110	symptoms	ON
13	Rahel	99	120	symptoms	ON
14	Joko	95	115	symptoms	ON
15	Mahi	96	102	symptoms	ON
16	Heri	95	122	symptoms	ON
17	Agung	95	118	symptoms	ON
18	Fitri	97	102	symptoms	ON
19	Ahmad	98	86	No symptoms	OFF
20	Chandra	96	90	No symptoms	OFF

From testing 20 samples of SpO2 levels and heart rate on the thumb finger, it can be seen on tests 1-10, 19, 20 indicating normal conditions (without symptoms), where oxygen saturation values (SP02 and heart rate) are still in normal levels. While the 11-18th test shows abnormal conditions (There are

Symptoms), where the oxygen saturation value (SP02 and heart rate) is above the normal value.

3.1 Implemented Tools

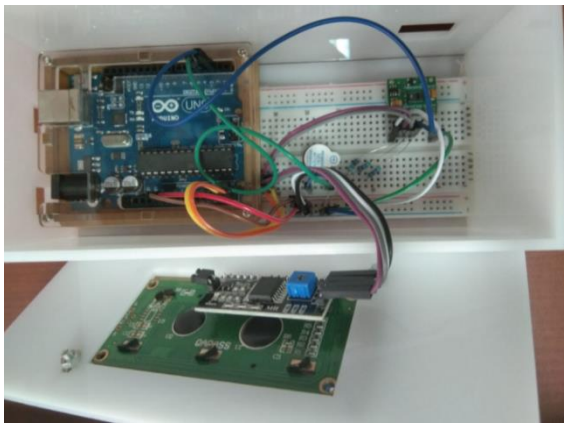

Figure 3: Inner View.

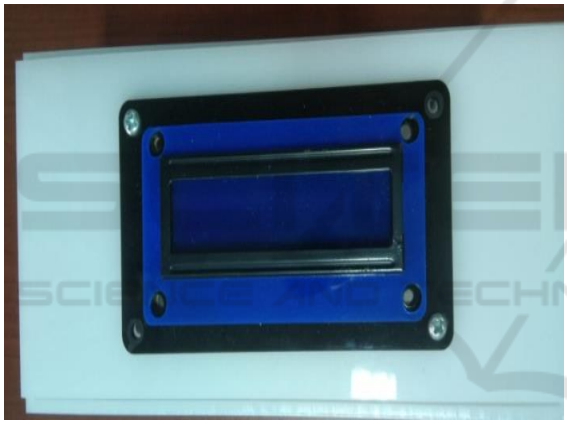

Figure 4: Top View.

Figure 5: Testing Directly with tools on the market. Desain Tools.

3.2 K-Means Clustering

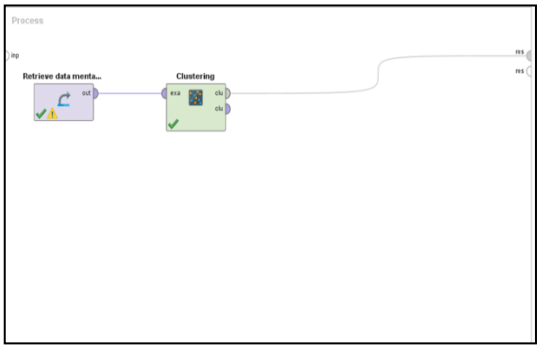

Figure 6: K-Means . Algorithm Process Design.

Figure 7: Clustering Results.

From the test results on the K-Means application, the membership of Cluster 0 is 12 items and Cluster 1 is 8 items with a total of 20 data tested. Each membership in detail will be shown in Figure 7

The following table compares the results of the clusterisasu test directly from the output of the designed tool and further testing using the K-Means algorithm.

Furthermore, further clusterization testing was carried out on 20 people who were tested, with the aim of confirming the test results in Table 1 using the K-Means algorithm. The test is carried out using the Neat Miner Application with a value of k = 2

Table 2: Comparison of Clustering Results.

No	Test Type	Clustering,without symptoms	Clustering,with symptoms
1	No Algoritma K-Means	1-10, 19,20	11-18
2	Using Algoritma K-Menas	1-10, 19,20	11-18

From the results of a direct comparison of the tool output with the results of data processing using the K-Means Algorithm with the Rapid Miner Application, the results of clustering (grouping) are the same in determining symptomatic or asymptomatic people by 100%

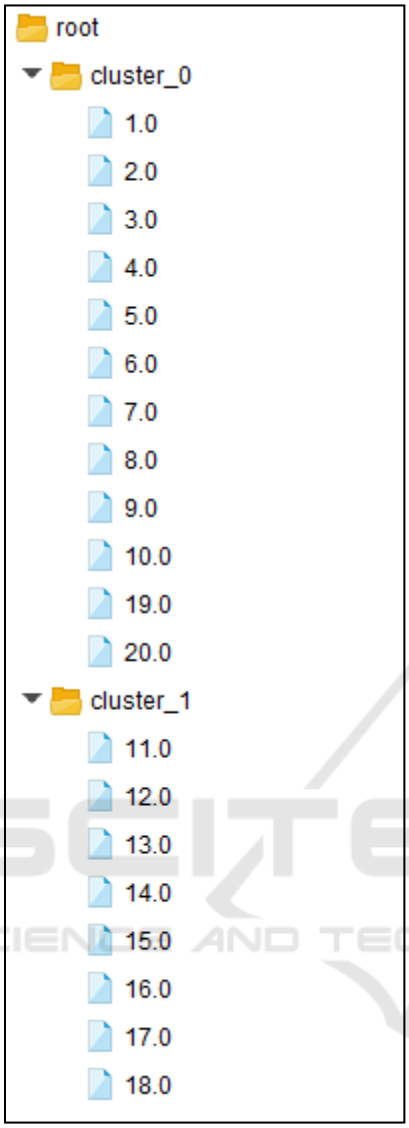

Figure 8: Membership of Each Cluster.

4 CONCLUSIONS

Based on the results of the research conducted, it can be concluded as follows: Tests for oxygen saturation levels and heart rate were carried out on the thumb and clustering using the K-Means Algorithm with the Rapid Miner Application was obtained on tests 1-10, 19, 20, no symptoms of covid-19 were found. because oxygen saturation levels and heart rate are still within normal limits. Meanwhile, in the 11-18 test, the symptoms of covi d-19 were found where the oxygen saturation value and pulse heart rate that exceeds normal values. The buzzer works well as a warning indicator if the oxygen saturation and heart rate values exceed normal values. Comparison of readings of clinical symptoms of shortness of breath through oxygen saturation levels. heart rate shows the same results between the output of the tool with testing using the K-Means algorithm.

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