Automated Rubber Seed Clones Identification Using Reflectance Sensors And Arduino

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***Abstract*— This project presents Automated Rubber Seed Clones Identification by using reflectance sensor (QTR-1A) connected with arduino. Nowadays, only have three people in Malaysia can decide the type of rubber seed clones. That is means until nowadays, still do not have intelligent device to decide the type of rubber seed clones. So, the main objective of this project is to develop an intelligent technology device that can provide easy way to the user. For this project, there are five types of rubber clones used is RRIM2002, RRIM2015, RRIM2020, RRIM2023 and RRIM2024 because it have potential produce high quality product and also familiar in Malaysia. In this project, there three reflectance sensor (QTR-1A) used and also located at different distance. It is because maybe it gives some effect to the result. The device measure the percentage of reflectance based on the intensity of light reflected from the front surface of rubber seed. Result analysis show the average voltage derived from the data and graph constructed, there are small differences of voltage for each type of clones. Finally, the conclusion was made that there are the brightness of brown color at front surface of rubber seed can be used in order to classify the types of rubber tree clones.**

Keywords-component : RRIM(Rubber Research Institute Malaysia)

I. INTRODUCTION

Rubber is one of an important raw material for manufacturing in the world. In Malaysia, rubber used to produce product such as tire, shoes, glove and others. Nowadays, rubbers get high demand in another country because most of the scientist found purpose of rubber. That why at one time, the value of rubber can reached until RM15.06 per kilogram in Malaysia [2].

Therefore, seeds planted must be from the quality rubber series clones such as RRIM2000 series. There are about 33 types of clone within the RRIM2000 Series. Many of farmer in Malaysia use this series because high quality and easy to get it.

However, only have three people in Malaysia can decide the type of rubber seed clones by looks the surface of seeds. These methods will take time, percentage accuracy and need costing in order to trained new worker or farmer with regards to the identification of rubber seed clones. That is means until nowadays, still do not have intelligent device to decide the type of rubber seed clones. So, the main objective of this thesis to create one intelligent device entitled 'Automatic Rubber Seed Clone Identification by Using Reflectance Sensor and Arduino'.

This project focused on pattern and color of rubber seed clones because there were many differences of intensity of color and pattern feature at seed's surface for each type of clone series. Each clone has different characteristics in terms of patterns, colors, size and shapes. In this project, light are suitable for rubber seed clone recognition. The reflectance sensor (QTR-1A) was used to extracted wavelength spectrum based on reflectance of light from seed's surface. The reflectance of light usually depends to brightness on color, pattern of surface and distance between seed's surface and sensor. Color is an important sign in the recognition of many conditions. It interacts with the surface and the interior of seed through absorption and scatterings. Thus, causes alteration in the spectral composition.

To get valid reading, the environment factors also very important. So, for this project have are two things that need to be carefully are the amount of light received by rubber seed and the distance between sensor and rubber seed. To make sure these factors do not give effect to reading, the amounts of light are constant. For the distance between sensor and rubber seed, the minimum value between sensor and rubber seed is 1mm and the maximum value is 6mm. The block used to ensure the distance between sensor and rubber seed are same. That is mean, the environment factors are important to ensure that all readings taken are valid and no error.

A. *Clone characteristics*

For this project, 5 familiar types of rubber seed clone used such as:

(a) RRIM 2002 (b) RRIM 2015 (c) RRIM 2020

(d) RRIM 2023 (e) RRIM 2024

Figure 1: Types of clone used

A) RRIM 2002

This clone recommended for both latex and timber production. The potential latex production is up to 2348 kg per hectare per year. The sizing of wood volume is 1.10 cubic metre per tree after 17 years of planting. The color of latex for this clone is yellow.[1]

B) RRIM 2015

This rubber seed are medium size. Smooth, shining with light brownish seed coat. This rubber seed are square to slightly ovoid. This clone is highly recommended for latex and timber production. The bole volume per tree at 14 years old is 0.43m³.[5]

C) RRIM 2020

This rubber seed are medium size. Smooth, shining with light brownish seed coat. This rubber seed are square to rectangular-shaped. This clone is highly recommended for latex and timber production. The bole volume per tree at 14 years old is 0.36m³.[5]

D) RRIM 2023

This clone recommended for both latex and timber production. The potential latex production is up to 2822 kg per hectare per year. The sizing of wood volume is 0.81 cubic metre per tree after 14 years of planting. The color of latex for this clone is white.[1]

E) RRIM 2024

This clone recommended for both latex and timber production. The potential latex production is up to 2685 kg per hectare per year. The sizing of wood volume is 1.26 cubic metre per tree after 14 years of planting. The color of latex for this clone is cream.[1]

II. METHODOLOGY

Flow chart below has shown the process to develop the 'Automatic Rubber Seed Clone Identification by using Reflectance Sensor and Arduino'.

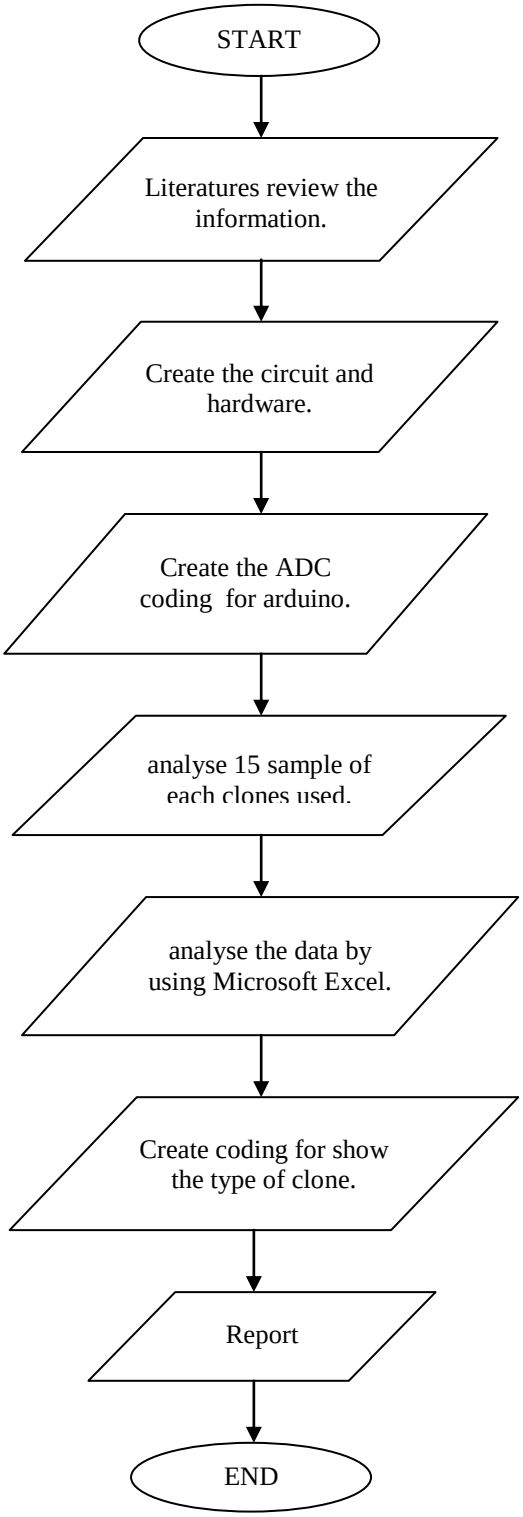

Figure 2: Methodology flow chart

A. *Hardware design*

For this project, Arduino Duemilanove and reflectance sensor (QTR-1A) used for the circuit. Arduino is an open source electronics prototyping platform based on flexible, easy to use hardware and software. It is intended for artists, designers, hobbyists and anyone interested in creating interactive objects or environments.[4]

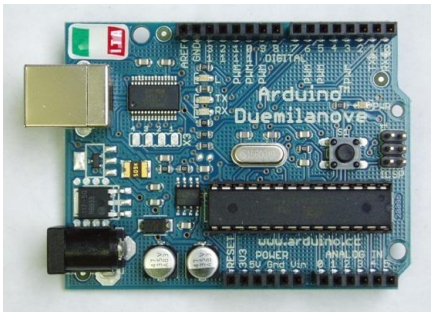

Figure 3: Arduino Duemilanove

The QTR-1A reflectance sensor carries a single infrared LED and phototransistor pair. The phototransistor is connected to a pull-up resistor to form a voltage divider that produces an analog voltage output between 0 V and VIN (which is typically 5 V) as a function of the reflected IR [3]. The reflectance sensor used to measure total of light reflected from the rubber seed surface according analog to digital value [3]. By using some equation, the value of voltage can be finding. However, the distance between the reflectance sensor and rubber seed surface are very nearly (minimum 1mm and maximum 6mm).

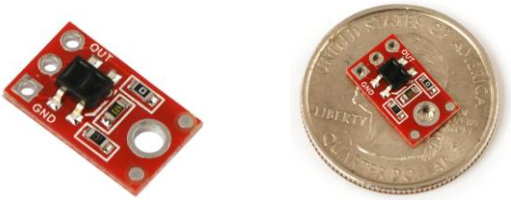

Figure 4: Reflectance sensor (QTR-1A)

To display the output, LCD shield for arduino are used. It includes a 2x16 LCD display and 6 momentary push buttons. Pins 4, 5, 6, 7, 8 and 9 are used to interface with the LCD [4].

Figure 5: LCD Display with shield

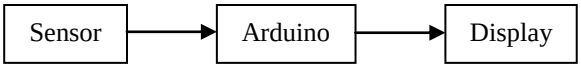

Figure 6: Hardware flow chart

B. *Analysis*

To get reading, the light reflection is very important. For this project, 3 sensors used and connected in parallel. The sensors are labeled as Sensor1(middle),Sensor2(right) and Sensor3(left). The sensors are connected to A1, A2 and A3 at arduino's analog input. It is directly connected to arduino because internal ADC are available inside arduino. The sensor read the rubber seed surface and produce the output in steps value. Because of the reading are very fast, the value cannot take by using LCD shield. The values taken by using computer and to create the table, manually calculating are used to ensure the value are accurate. However, the reading still can be find by using LCD display with put the equation into the coding. The equation has shown as below:

Voltage = 5/1023 x ADC value

When the collecting data process is done, the graph are plotted by using Microsoft Excel. The graph are plotted to decide range voltage for every rubber seed clone. From the range voltage, the characteristic for every type of rubber seed clone can be determined.

III. RESULT AND DISCUSSION

When the analyse process is done, the graph are plotted by using Microsoft Excel. 15 samples for every types of clone used. The result shown as:

A) RRIM2002

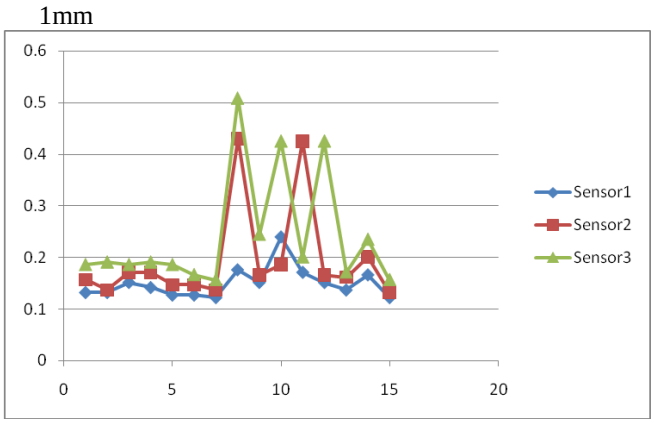

Figure 7.1: Graph RRIM 2002 for 1mm

6mm

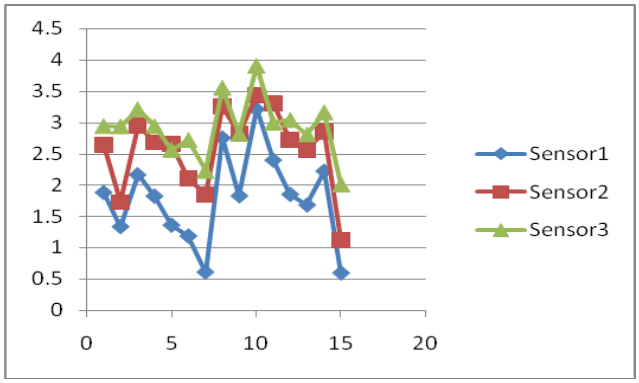

Figure 7.2: Graph RRIM 2002 for 6mm

B) RRIM 2015

1mm

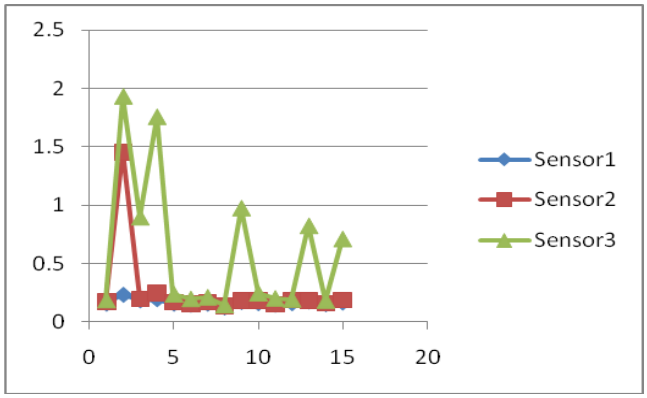

Figure 7.3: Graph RRIM 2015 for 1mm

6mm

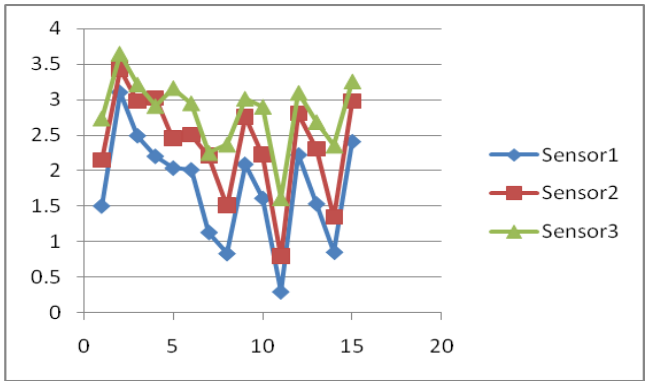

Figure 7.4: Graph RRIM 2015 for 6mm

C) RRIM 2020

1mm

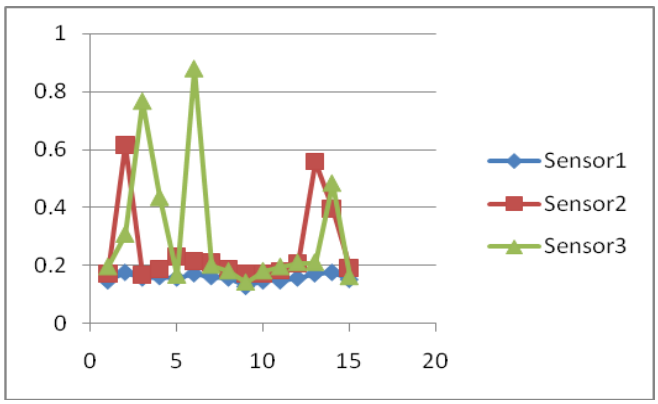

Figure 7.5: Graph RRIM 2020 for 1mm

6mm

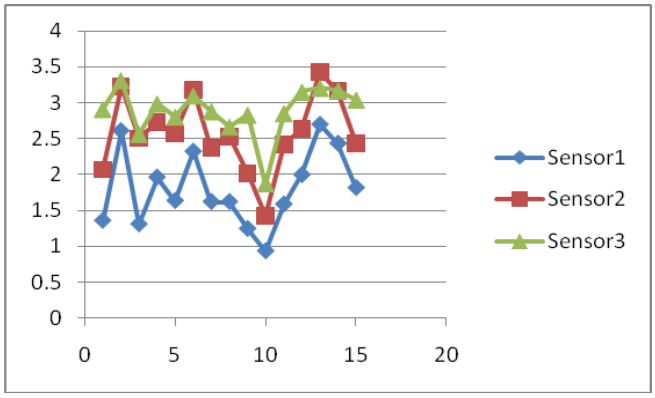

Figure 7.6: Graph RRIM 2020 for 6mm

D) RRIM 2023

1mm

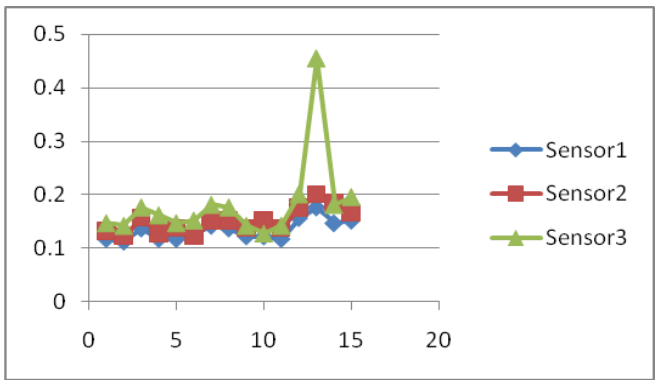

Figure 7.7: Graph RRIM 2023 for 1mm

6mm

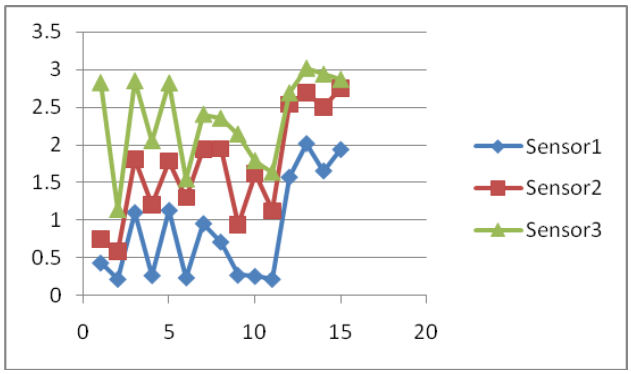

Figure 7.8: Graph RRIM 2023 for 6mm

E) RRIM 2024

1mm

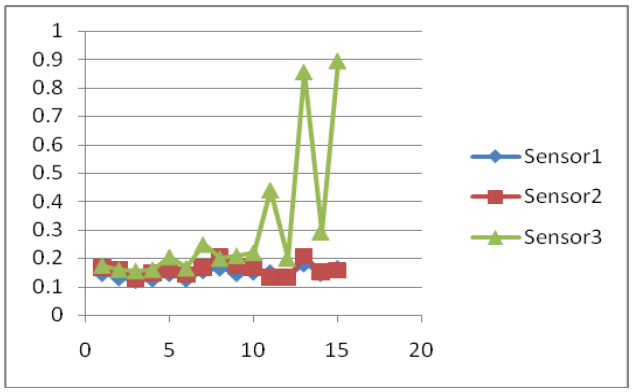

Figure 7.9: Graph RRIM 2024 for 1mm

6mm

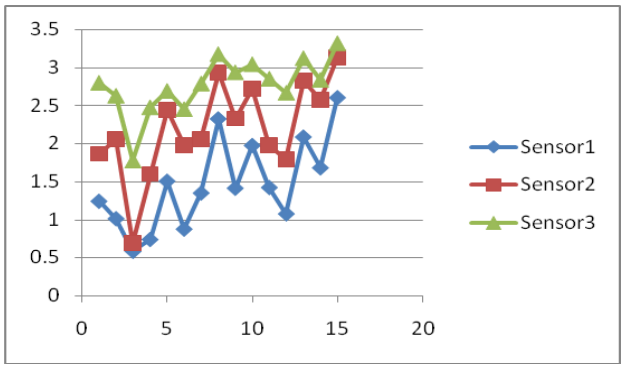

Figure 7.10: Graph RRIM 2024 for 6mm

The graphs on Figure 7.1 to 7.10 shown the analyse result for every types of clone used. 3 sensors used is Sensor1 (middle), sensor2 (right) and sensor3 (left) show different range voltage. That is mean the position of sensor give effect the reading. Another that, the characteristics of every types of clone can be determined based on the graph above. The table below shown the average voltage of rubber seed clones used.

Table 1

Clone	Average voltage (1mm)		
	Sensor1 (middle)	Sensor2 (right)	Sensor3 (left)
RRIM 2002	0.1499 V	0.1955 V	0.2418 V
RRIM 2015	0.1662 V	0.2607 V	0.5966 V
RRIM 2020	0.1577 V	0.2574 V	0.3148 V
RRIM 2023	0.1336 V	0.1509 V	0.1818 V
RRIM 2024	0.1476 V	0.1597 V	0.3360 V

Table 2

Clone	Average voltage (6mm)		
	Sensor1 (middle)	Sensor2 (right)	Sensor3 (left)
RRIM 2002	1.801 V	2.621 V	2.964 V
RRIM 2015	1.757 V	2.394 V	2.847 V
RRIM 2020	1.822 V	2.626 V	2.933 V
RRIM 2023	0.8635 V	1.734 V	2.371 V
RRIM 2024	1.468	2.239	2.822

F) Middle sensor (sensor1)

6mm

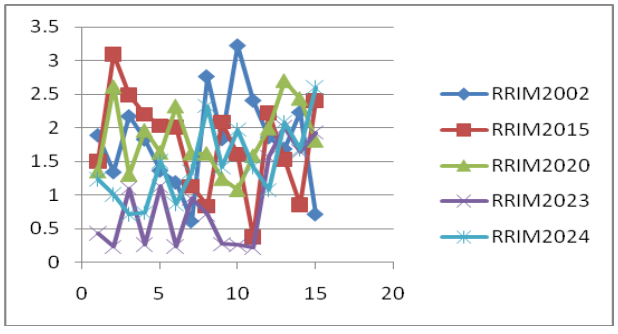

Figure 8.1: Graph middle sensor for 6mm

Table 3

Clone	Range voltage
RRIM 2002	0.5 V- 3.3 V
RRIM 2015	0.2 V- 3.1 V
RRIM 2020	0.9 V- 2.8 V
RRIM 2023	0.2 V- 2.1 V
RRIM 2024	0.5 V- 2.7 V

Right sensor (Sensor2)

6mm

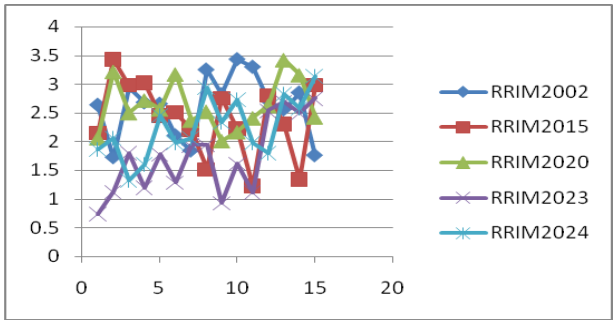

Figure 8.2: Graph right sensor for 6mm

Tabel 4

Clone	Range voltage
RRIM 2002	1.0 V- 3.5 V
RRIM 2015	0.7 V- 3.5 V
RRIM 2020	1.4 V- 3.5 V
RRIM 2023	0.4 V- 2.8 V
RRIM 2024	0.6 V- 3.2 V

Left Sensor (Sensor3)

6mm

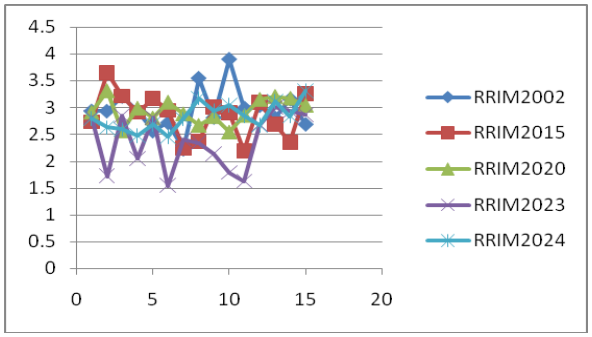

Figure 8.3: Graph left sensor for 6mm

Table 5

Clone	Range voltage
RRIM 2002	1.6 V- 3.9 V
RRIM 2015	1.6 V- 3.7 V
RRIM 2020	1.7 V- 3.4 V
RRIM 2023	0.9 V- 3.1 V
RRIM 2024	1.6 V- 3.4 V

The graphs on Figure 8.1, 8.2 and 8.3 shown the combination of analyse result for every type of clones used. From the result, the characteristics for every type of clones can determined. However, the graphs shown not smoothly. The values of range voltage for every types of clone are very closed to each other. That is mean, very difficult to decide the types of clone.

Many factors are need to considered because every factor give effect to the result. The factors such as:

- The rubber seed's surface damage.
- Same clone but different size of rubber seed.
- Same clone but different color of rubber seed.
- Different distance for each sensor used.
- Shadow at rubber seed's surface.
- Unsuitable plateform used.(permanent)

G) Middle sensor (1mm and 6mm) for RRIM 2002

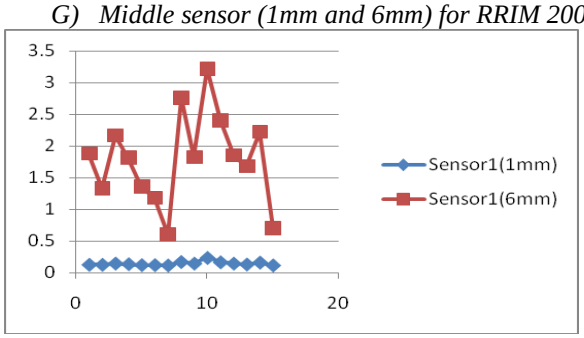

Figure 9.1: Middle sensor (1mm and 6mm) for RRIM 2002

Right sensor (1mm and 6mm) for RRIM 2002

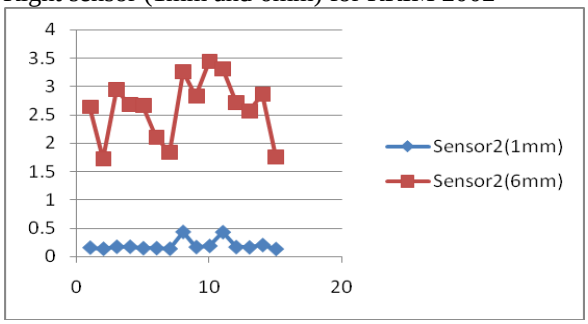

Figure 9.2: Right sensor (1mm and 6mm) for RRIM 2002

Left sensor (1mm and 6mm) for RRIM 2002

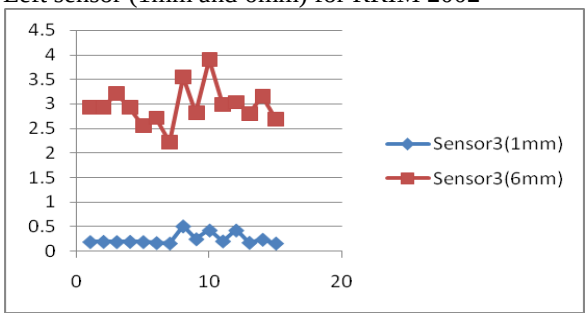

Figure 9.3: Left sensor (1mm and 6mm) for RRIM 2002

The graph on Figure 9.1, 9.2 and 9.3 shown the analyse result to show the different between 1mm and 6mm for RRIM 2002. From the graphs, the result has shown when the distance between sensor and rubber seed's surface increase, the value of range voltage also will be increase.

IV. CONCLUSION

A. *Conclusion*

The five types of clone can be decided the characteristics by measure the range voltage for every clones. However, from the result, the values of range voltage for every clone are very closed. It is because most of factors give effect to the result and difficult to solve it. For the distance between sensor and rubber seed's surface if 1mm and 6mm, the result shown when the distance between sensor and rubber seed's surface increase, the value of range voltage also will be increase. That is mean, the distance between sensor and rubber seed's surface need considered to ensure the result will be accurate.

B. *Recommendation*

In future, the factors give effect the result need to solved to reduce the error on the result. For example, as we know, the distance between sensor and rubber seed's surface give effect to the result. So, the platform used can be changed with variable platform to ensure the distance between sensor and rubber seed's surface are more accurate.

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