Rubber Seed Clones Identification Using LDR Module Combined With Arduino

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***Abstract* - The rubber seed clones identification are presented using LDR sensor and Arduino as a controller. The main objective of this project is to create an intelligent and simple identification of rubber seed that can recognize the clones based on colour being reflected by LDR module sensor. Rubber seed clones has different textures and colour characteristic though observation. The functions of this project are to select the best rubber tree series by using light dependent resistor (LDR) for analyze the intensity of light being reflected through a surface rubber seed. These projects need to identify five types of rubber seed clones. There are RRIM 2009, RRIM 2016, RRIM 2008, RRIM 2011 and RRIM 2005. The three of LDR module sensor are used and located at different distance to take the sample of reading. The device measure the percentages of reflectance based on the intensity of light reflected from the rubber seed surface. The output voltage measurement is then analyzed using recommended statistical test to identify the type of rubber seed. The Microsoft Office Excel was used to analysis the average voltage that convert from light reflect by takes 30 sample readings from 5 difference clones. The analyses are show in TABLE and graph and decided to take the average range as a conclusion to compare the type of every clone.**

Keywords:-Rubber Seed, LDR module, Arduino.

I. INTRODUCTION

Rubber was first introduced in Malaysia in 1888. With the invention of cars, the demand for rubber, particularly for the production of tires and others. Malaysia became the main supplier of rubber early in the 20^{th} century. To date, there are still around 1.3 million ha of land planted with rubber in Malaysia with a resurgent interest in new plantings. The estimated planting material requirement is about 3.2 million plants with a market value of RM6.4 million (RM2 per plant). Rubber is currently being planted using two whorled budding with some opting for open-pollinated seedlings from polyclonal seed garden. The trade of planting material will not greatly accelerate as traditionally, rubber growers buy improved buddings only once and will subsequently multiply further buddings themselves. The task of breeding and evaluation of rubber clones is credited to the Malaysian Rubber Board (MRB), previously known as the Rubber Research Institute of Malaysia (RRIM). The most significant achievement has been in developing new rubber varieties or clones with high-yielding trees producing more than 3,500 kg latex per hectare per year and the introduction and cultivation of disease-resistant clones. Rubber Research Institute of Malaysia (RRIM) exploits the R&D to find the best technology had been used to develop the upstream, downstream and processing sectors [1].The conventionally fundamental that had been used before this is by looking at the seed and tries to match its shape, weight, colour and pattern texture photo from the library text. This project is enhancement from previous project, and use three LDR module as a sensor detector to identify the clone types. LDR are the resistors whose resistance varies with the intensity of light incident upon it. The resistance is typically very high when no light in incident and it begins to reduce as light is incident upon it. So by doing this project the amount of intensity light will change at every types of clone because of their shape, weight, colour and pattern texture.

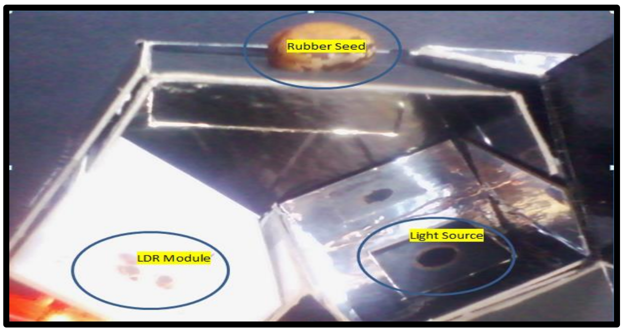

Figure 1. Rubber seed clones identification prototype

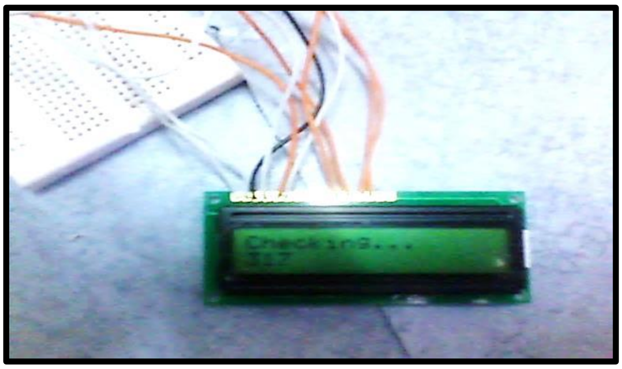

Figure 2. Take the Reading

A. Clone characteristic:

The Figure 3 until 7 shows the characteristic of every seed clone that used in this experiment.

Figure 3. RRIM 2009

I. RRIM 2009

The seed is smooth, shining with light brownish seed coat. Slightly rounded shape and the growth seed production is very good. This type recommended for both latex and timber production.[2,3]

Figure 4. RRIM 2016

II. RRIM 2016

Seed features almost same with RRIM 2009 but it has square shaped of seed and brightness are lighter than RRIM2009.This clone are recommended for latex and timber. [3]

Figure 5. RRIM 2011

III. RRIM 2011

The seed feature and size of this clone is similar to RRIM2009 but the RRIM2009 is brighter compared to this clone. Overall growth and seed production of this clone is good. This clone also recommended for both latex and timber production.[3]

Figure 6. RRIM 2005

IV. RRIM 2005

The seed is medium and the best type of clone recommended for both latex and timber production. [4]

Figure 7. RRIM 2008

V. RRIM 2008

The seed is large and brownish seed coat. This clone used for both latex and timber. [5]

II. METHODOLOGY

Methodology part will cover in term of sample collection, hardware and software design and experiment process. The process involved in the development of the project is very useful to make the process smooth without any problems. The methodology for this project has several steps to make it perfect which is literature review, hardware development, programming microcontroller, analysis, capture the data, troubleshooting and report.

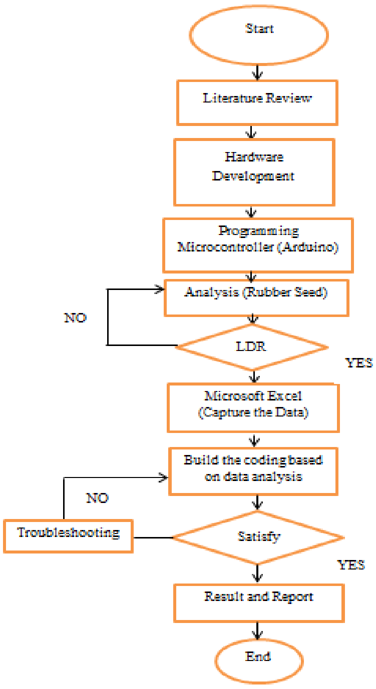

Figure 8. Flow chart (Overview)

A. *Literature Review*

The previous works related to this project are studied and analysed in order to determine the disadvantages in their researches or projects and try to overcome the problem statements. By analysing the projects, there is a possibility to know what features are lacking in projects that being work on. The process extended right from the start until the end of the project by reviewing the previous works and redesigns the hardware to get the accurate result better than previous project. Every colour and pattern is the main factor to produce different ADC value and know the type of clone been used. Take average 30 samples of seed for each type clone. Get the data and analyse by doing statically method to see the result between theoretical and practical whether match or not.

B. *Hardware Development*

The hardware proposed in this project consists of three main parts which is input (rubber seed and LDR module), controller (arduino) and output (LCD display). Controller will produce ADC value and it will display the value at LCD display.

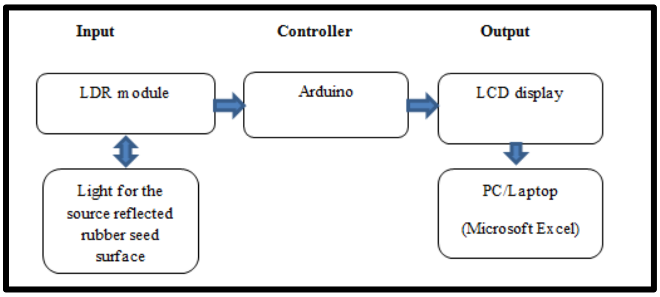

Figure 9. Process flow rubber seed identification system

To measure the reflectance of light, a hardware cover must design such as in figure 10. Besides, it is to make sure sensor can capture maximum reflectance light from rubber seed surface. The mirror is been used to make sure the light source is direct to the seed and it will reflected back to the sensor. This is to make sure that maximum amount of light will receive at the LDR module. The room light also can affect the reading, so the hardware must build to cover the hold surface rubber seed.

Figure 10. Hardware Cover

The schematic cover design like as figure 11. It shows the position of light and sensor as well as correct angle used for maximum light incident and reflectance. In addition the angle of reflection is very important in order to get the best outcomes regarding to the intensity of light from rubber seed. From the law of reflection angle of incidence (*i*) is equal to the (*r*), both angle has determined which are *i*=30 and r=30. Furthermore, the distance between the seed and the light source also important [8, 9].

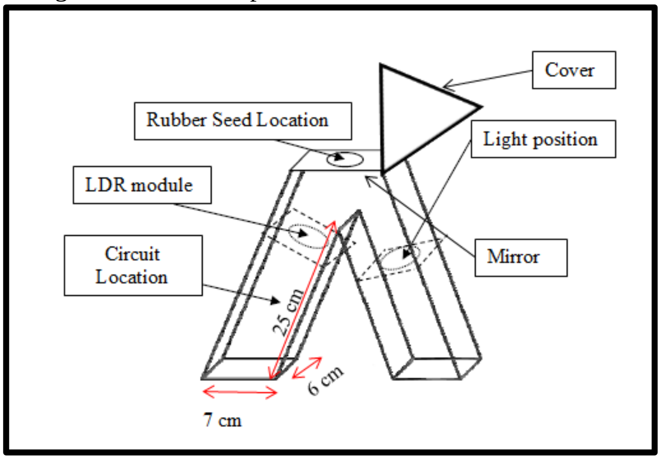

Figure 11. Schematic Hardware

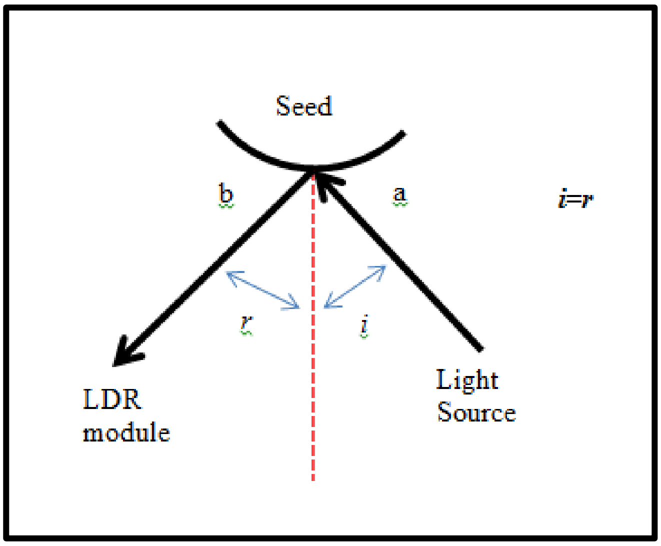

Figure 12. Law of reflection

C. Experiment process

The maximum light of reflection was very important when readings were taken during the experiments. The sensors were arranged in triangle, to get three different readings from the hold surface. Three sensors were connected to port A0, A1 and A2 since the internal ADC was made available on Arduino itself. The sensors read the sample for 30 times to get an average reading of the ADC. The ADC value obtained was converted to voltage output by using the equation provided in Figure 13[7].

$$V = 5\ x \left(ADC\,Value\ \ x\ \ \frac{1000}{1023} \right)$$

Figure 13. Equation to convert ADC to voltage

D. Software system

Data obtain from experiment setup used as a reference in order to identify the type of rubber seed clones. This project is using Arduino Uno software for programming the PIC microcontroller. The voltage to on the PIC is 5V either from adapter or USB port PC. In this project the pin mode A0, A1, A2 as input port for LDR module sensors. The A3 as an input port for LCD display. In this project analog input are used to measure the rubber seeds. This means for the LDR module sensor it using analog input to measure and decided the clone of rubber seed. The software system in this project consists of five conditions which is RRIM 2009, RRIM 2016, RRIM 2011, RRIM 2005, and lastly RRIM 2008.

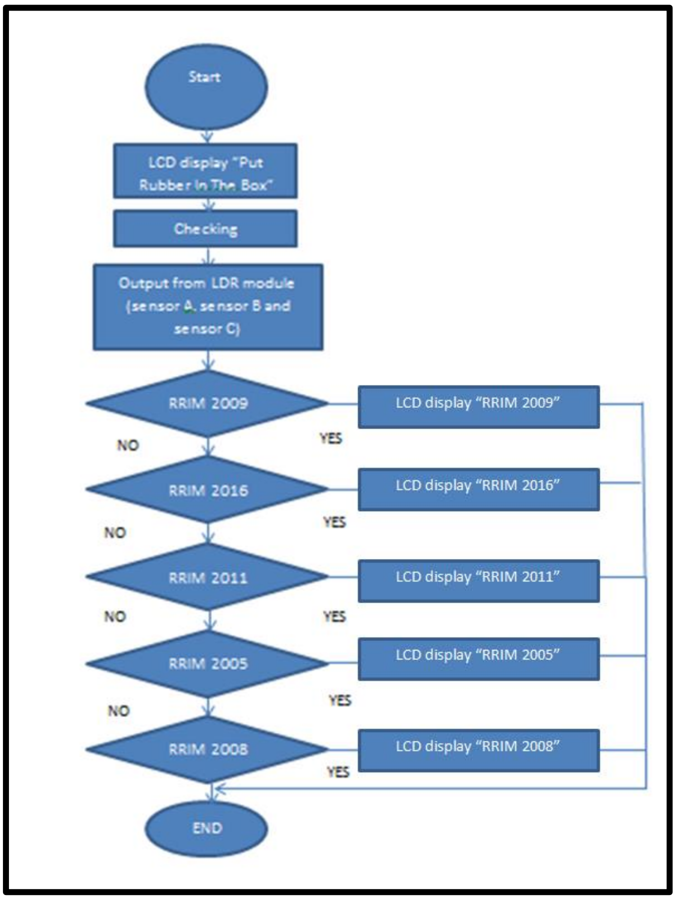

Figure 14. Flow Chart of Rubber Seed Identification

III. Result And Discussion

The resistance of the LDR gets smaller when there have lighting is increases.

The figures below are showing the data analysis for 30 samples of seed clone to determine the average of ADC for this each type. Every seed are measure based on 3 sensors tested. There are Sensor A, Sensor B, and Sensor C.

I. Average ADC

A. RRIM 2009

Figure 15 shows graph plot RRIM 2009 for number of sample from 1 to 30 samples versus average ADC value for sensor A, B and C.

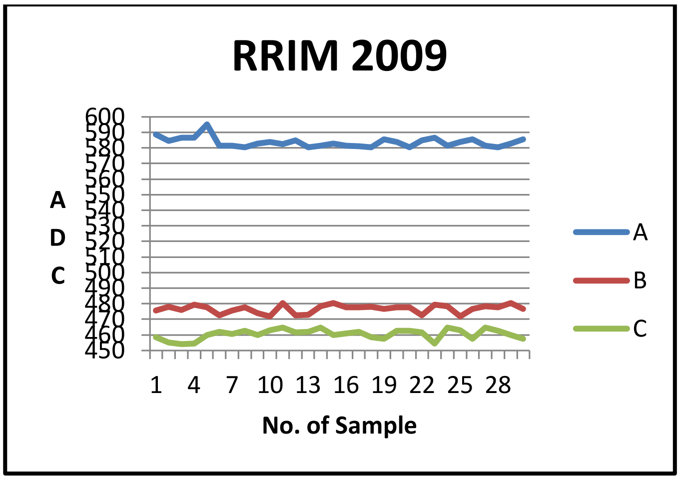

Figure 11. RRIM 2009

B. RRIM 2016

Figure 16 shows graph plot RRIM 2016 for number of sample from 1 to 30 samples versus average ADC value for sensor A, B and C.

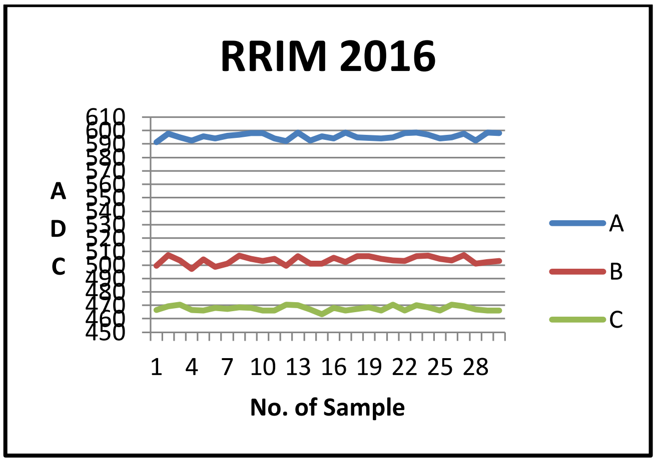

Figure 16. RRIM 2016

C. RRIM 2011

Figure 17 shows graph plot RRIM 2011 for number of sample from 1 to 30 samples versus average ADC value for sensor A, B and C.

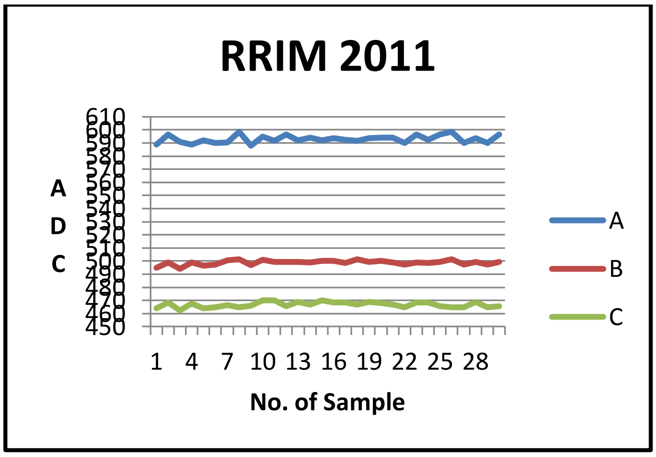

Figure 17. RRIM 2011

D. RRIM 2005

Figure 18 shows graph plot RRIM 2005 for number of sample from 1 to 30 samples versus average ADC value for sensor A, B and C.

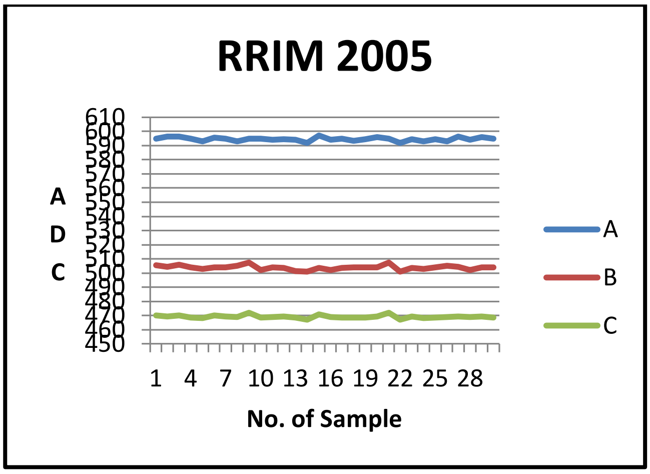

Figure 18. RRIM 2005

E. RRIM 2008

Figure 19 shows graph plot RRIM 2008 for number of sample from 1 to 30 samples versus average ADC value for sensor A, B and C.

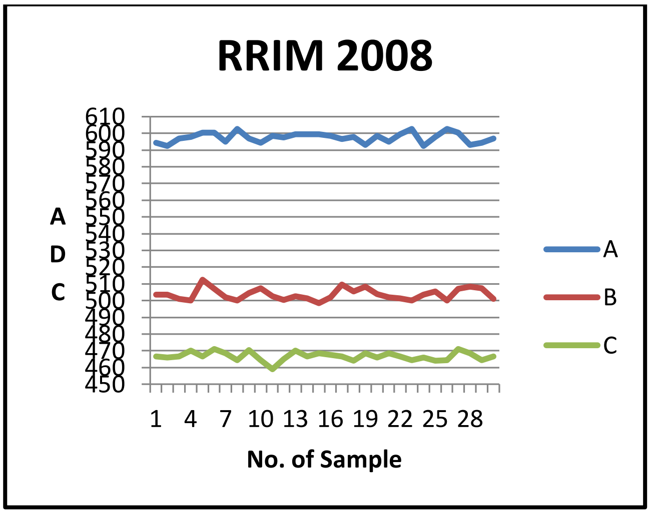

Figure 19. RRIM 2008

These experiments are performed to collect frequencies of wavelength that have been reflected. In orders to records the necessary range of average voltages, all the possibilities had taken. Table 1 shows average of ADC value for all type rubber seed clone according to 30 samples given.

TABLE 1. AVERAGE ADC

No. of Sample	Type of Rubber Seed				
	RRIM 2009(AVE)	RRIM 2016(AVE)	RRIM 2011(AVE)	RRIM 2005(AVE)	RRIM 2008(AVE)
1	507.500	519.167	516.000	523.500	521.500
2	505.833	524.833	521.333	523.500	520.667
3	505.500	523.000	515.833	524.167	521.500
4	506.833	518.667	518.500	522.500	522.667
5	510.833	521.833	517.500	521.333	526.500
6	505.333	520.167	517.500	523.167	526.167
7	505.833	521.500	519.167	522.833	521.833
8	506.833	524.167	521.667	522.333	522.333
9	505.667	523.500	517.000	524.833	524.000
10	506.333	522.333	522.000	521.833	522.167
11	509.167	521.500	520.333	522.333	520.000
12	506.333	520.667	520.500	522.500	521.000
13	505.167	525.000	520.167	521.333	524.000
14	508.167	520.167	520.000	520.000	522.500
15	507.833	520.000	520.667	523.833	522.167
16	506.667	522.500	520.667	521.667	522.667
17	506.833	522.167	519.833	522.333	524.167
18	505.667	523.000	520.000	522.000	522.500
19	506.500	523.167	520.667	522.333	523.333
20	508.000	521.500	520.667	523.167	522.833
21	506.833	523.000	520.000	524.833	521.833
22	506.333	522.333	517.500	520.000	522.500
23	506.833	525.000	521.333	522.500	522.333
24	508.167	524.167	519.833	521.333	520.667
25	506.333	521.500	520.500	522.333	522.500
26	506.500	523.000	521.667	522.333	522.333
27	508.167	524.833	517.500	523.500	526.167
28	506.833	520.167	520.667	521.667	523.333
29	507.833	522.167	517.500	523.167	522.167
30	506.500	522.333	520.500	522.500	521.500

An analysis on the data done and test with Anova one way test and error plot to detect if any significant discriminating result.

II. Anova One Way Test

TABLE 2. ANOVA TEST RRIM 2009

RRIM 2009	
Mean	506.906
Standard Error	0.223
Median	506.750
Mode	506.833
Standard Deviation	1.222
Sample Variance	1.494
Kurtosis	2.401
Skewness	1.258
Range	5.667
Minimum	505.167
Maximum	510.833
Sum	15207.167
Count	30.000
Confidence Level(95.0%)	0.456

TABLE 3. ANOVA TEST RRIM 2016

RRIM 2016	
Mean	522.244
Standard Error	0.314
Median	522.333
Mode	523.000
Standard Deviation	1.721
Sample Variance	2.963
Kurtosis	-0.538
Skewness	-0.171
Range	6.333
Minimum	518.667
Maximum	525.000
Sum	15667.333
Count	30.000
Confidence Level(95.0%)	0.643

TABLE 4. ANOVA TEST RRIM 2011

RRIM 2011	
Mean	519.567
Standard Error	0.317
Median	520.083
Mode	517.500
Standard Deviation	1.734
Sample Variance	3.007
Kurtosis	-0.543
Skewness	-0.749
Range	6.167
Minimum	515.833
Maximum	522.000
Sum	15587.000
Count	30.000
Confidence Level(95.0%)	0.648

TABLE 5. ANOVA TEST RRIM 2005

RRIM 2005	
Mean	522.522
Standard Error	0.211
Median	522.417
Mode	522.333
Standard Deviation	1.155
Sample Variance	1.335
Kurtosis	0.446
Skewness	-0.093
Range	4.833
Minimum	520.000
Maximum	524.833
Sum	15675.667
Count	30.000
Confidence Level(95.0%)	0.431

TABLE 6. ANOVA TEST RRIM 2008

RRIM 2008	
Mean	522.661
Standard Error	0.285
Median	522.417
Mode	522.500
Standard Deviation	1.559
Sample Variance	2.430
Kurtosis	1.168
Skewness	1.033
Range	6.500
Minimum	520.000
Maximum	526.500
Sum	15679.833
Count	30.000
Confidence Level(95.0%)	0.582

III. Error Plot

The result error plot is shown in figure 20.The error plot shown that the variation of the sample population mean of the output root mean square (ADC) for all type rubber seed clone.

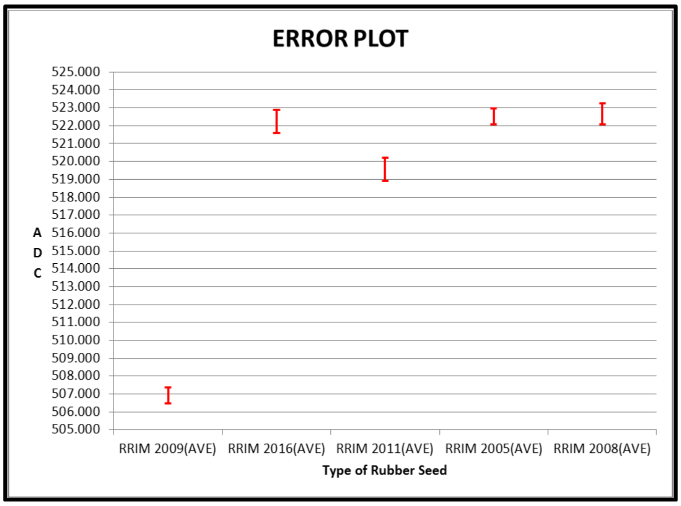

Figure 20. Error Plot

From the observation on figure 20, there is no overlapping between clone RRIM 2009 and RRIM 2011 with another clones. For clone type RRIM 2016, RRIM 2005 and RRIM 2008 the problem occur because error plot shown the data for three types actual had the same value. So the system is hard to analyse the type of RRIM 2016, RRIM 2005 and RRIM 2008.

Meanwhile, Table 7 shows parameter measurement for all five types of rubber seed clone. Parameters involves are minimum and maximum value, mean and confidence interval for 95%. Minimum and maximum value can be proven by refer to error plot, means that, which type of rubber clone seed that overlap with each other.

TABLE 7. DESCRIPTIVE STATISTICS

Clone	N	Min	Max	Mean	CI(95%)
RRIM 2009	30	505.167	510.833	506.906	0.456
RRIM 2016	30	518.667	525.000	522.244	0.643
RRIM 2011	30	515.833	522.000	519.567	0.648
RRIM 2005	30	520.000	524.833	522.522	0.431
RRIM 2008	30	520.000	526.500	522.661	0.582

IV. CONCLUSION

In conclusion objective of this project is achieving that is to know how to identify circuit problems and identify best method to solve the problem to design rubber seed identification. Also that, to use this project the type of RRIM 2009, 2011 and 2016 are relevant but for another are not because had the overlapping data. So to make this project can be useful, needed to test another types of clone to compare the data whether it can be used or not. In addition, from this project soldering technique and c language can been improved. Furthermore, to design a rubber seed clones identification using LDR module combined with arduino has been successfully build and implemented.

V. RECOMMENDATION

In the future, a complete research for RRIM 2000 series rubber clone could be carried out to enhance the technology of classifying the rubber seed clones. more rubber seed clones can be use as sample for this research. To date, there are 33 clones under the RRIM 2000 series rubber clone[6].So, as a recommendation for future work, more input parameters are required for better performance such as added more than one sensor at the receiver part.Besides, use laser to get an accurate straight lamp source. Try to design hardware that can cover the whole surface of rubber seed.The percentage accurancy will increase if the recomendation can full fill.In addition,to get the accurate analysis, more rubber seeds sample are need to test

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