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ARDUINO MKR FOX 1200, MKR1000, AND MKR VIDOR 4000 ANALYSIS USING A SIMPLE RTC ALARM METHOD

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Abstract

Arduino MKR is one part of the Arduino family that has different capabilities from ordinary Arduinos. In this study, the author will discuss the capabilities of the RTC IC that have been embedded in the Arduino MKR board and compare the data from the accuracy of reading the RTC value. The value obtained will indicate the Arduino MKR board that has the best RTC value reading ability. The Arduino MKR board used in this study is the Arduino MKR 1000, Arduino MKR Fox 1200, and Arduino MKR Vidor 4000 types. To support the research, the author uses experimental quantitative research methods. The use of this method is very suitable because this method emphasizes numbers as data and the author also conducts experiments directly on the Arduino MKR board. After the research was conducted, the experimental results obtained that the MKR 1000 had the smallest time difference of 2,912 seconds compared to the MKR Fox 1200 with an average time difference of 4,097 seconds and the MKR Vidor 4000 had an average time difference of 5,804 seconds. For projects that use RTC (Real Time Clock), it is recommended to use MKR 1000.

Keywords: *Arduino MKR 1000, Arduino MKR Fox 1200, Arduino MKR Vidor 4000, Simple RTC Alarm*

Abstrak

Arduino MKR merupakan salah satu bagian dari keluarga arduino yang memiliki kemampuan yang berbeda dengan arduino biasa. Dalam penelitian ini, penulis akan membahas kemampuan dari IC RTC yang sudah tertanam pada papan Arduino MKR dan membandingkan data dari ketelitian pembacaan nilai RTC. Nilai yang didapatkan akan menunjukkan papan Arduino MKR yang memiliki kemampuan pembacaan nilai RTC terbaik. Adapun papan Arduino MKR yang digunakan dalam penelitian ini yaitu dengan tipe Arduino MKR 1000, Arduino MKR Fox 1200, dan Arduino MKR Vidor 4000. Untuk mendukung penelitian, penulis menggunakan metode penelitian kuantitatif eksperimental. Penggunaan metode ini sangat cocok digunakan karena metode ini menonjolkan angka sebagai data dan penulis juga melakukan percobaan langsung pada papan Arduino MKR. Setelah penelitian dilakukan, maka dari hasil percobaan diperoleh rata-rata MKR 1000 memiliki selisih waktu terkecil sebesar 2.912 detik dibandingkan dengan MKR Fox 1200 dengan selisih waktu rata-rata 4.097 detik dan MKR Vidor 4000 memiliki selisih waktu rata-rata 5.804 detik. Untuk proyek yang menggunakan RTC (Real Time Clock) direkomendasikan menggunakan MKR 1000.

Kata Kunci: *Arduino MKR 1000, Arduino MKR Fox 1200, Arduino MKR Vidor 4000, Simple RTC Alarm*

1. INTRODUCTION

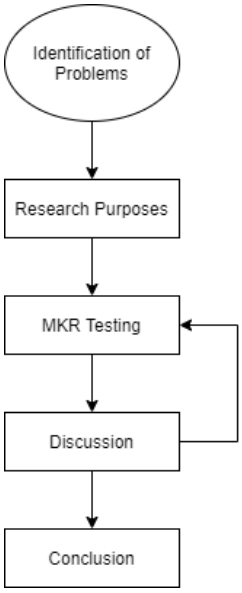
For automation-based activities, a micro-sized computer was found that functions to control other devices called microcontrollers [1][2][3]. Arduino MKR is an example of a microcontroller created for makers and engineers to quickly prototype IoT projects [4][5][6][7]. The Arduino MKR board has an RTC IC embedded. In this paper, researchers want to test and analyze RTC ICs on several Arduino MKRs, namely Arduino MKR 1000, Arduino MKR Fox 1200, and Arduino Vidor 4000 [8][9].

The Arduino MKR1000 is a powerful board that combines the functionality of Zero and Wi-Fi Shield. It is an ideal solution for builders looking to design IoT projects with minimal prior networking experience [10]. The Arduino MKR1000 has been designed to offer a practical and cost-effective solution for builders looking to add Wi-Fi connectivity. Arduino MKR Fox 1200 is a developer board embedded ATMEL SAMD21 as a microcontroller designed to integrate low power consumption and high performance [11]. The MKRFOX1200 delivers Arduino Zero functionality in a smaller form factor defined by the Arduino MKR1000 adding SigFox connectivity to the Arduino platform [12][13]. Arduino MKR Vidor 4000 is a new type of board from the MKR family which includes the most powerful reprogrammable chip, the FPGA, and the Microchip SAMD21 microcontroller [14][15][16].

The RTC ICs of each Arduino MKR board are suspected of having different capabilities [17]. By getting data from the results of the experiment, it is expected to know the highest level of accuracy of the RTC IC on the Arduino MKR.

2. RESEARCH METHOD

In the research method section, it will be explained how the flow of the research from beginning to end. In the early part of the research, the researcher conducted a case study regarding the differences in the RTC IC capabilities of the Arduino MKR until later they found results in the form of data on the difference in values from the experimental results on each Arduino MKR board. The following is the flow of this research.



Picture 1. Problem Solving Diagram

The steps involved in making this research are as follows:

a. Identification of problems
   Problem identification is the first step in the preparation of this paper. At this stage, the author suspects that the RTC IC on each Arduino MKR has different capabilities. This RTC IC is already embedded on the Arduino MKR board and is useful as a register that can store seconds, hours, minutes, hours, date, month, and year data.
b. Research purposes
   The purpose of this research is to determine the ability of the RTC IC on the Arduino MKR board. The MKR boards used in this study are Arduino MKR 1000, Arduino MKR Fox 1200, and Arduino MKR Vidor 4000. By using the Simple RTC Alarm project method, researchers can review the capabilities of the RTC IC that have been embedded in each Arduino MKR.
c. MKR Testing
   The testing step in this study begins with making initial settings on each Arduino MKR board, both driver settings, library additions, and board manager settings. After all these processes have been completed, the Simple RTC Alarm test is carried out on each Arduino MKR board and each Arduino MKR board, an experiment is carried out 50 to get more data as a comparison of results. The results obtained will later be collected to determine the level

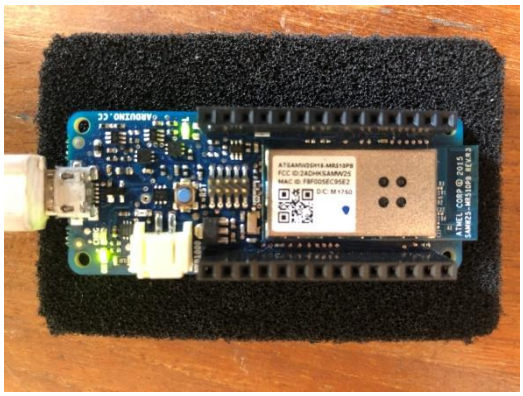
of accuracy of the RTC ICs owned by each Arduino MKR board.

d. Discussion
   At this stage, the researchers collected data from the results of the tests in the previous stage. At the discussion stage, the researchers also analyzed the capabilities of each RTC IC on each Arduino MKR board in running the Simple RTC Alarm program. The data that will be covered is the time of setting the alarm and the time when the board gets a match with the alarm time.

e. Conclusion
   The conclusion is the last stage in the process of writing this research. At this stage the authors summarize all the data and provide results in the form of the main objectives of this study.

3. RESULT AND DISCUSSION

This study uses several types of microcontrollers from the Arduino family, namely Arduino MKR, to be precise, Arduino MKR 1000, Arduino MKR Fox 1200, and Arduino MKR Vidor 4000.

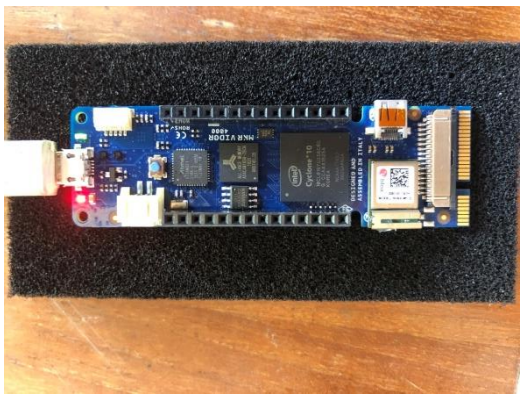


Picture 2. Arduino MKR 1000

The Arduino MKR1000 is a powerful board that combines the functionality of Zero and Wi-Fi Shield. It is an ideal solution for builders looking to design IoT projects with minimal prior networking experience. The Arduino MKR1000 has been designed to offer a practical and cost-effective solution for builders looking to add Wi-Fi connectivity.

Picture 3. Arduino MKR Fox 1200

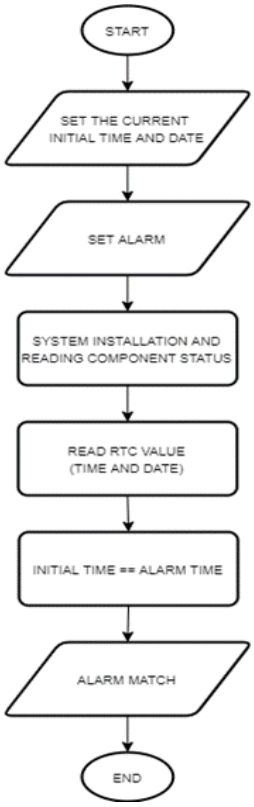
Arduino MKR Fox 1200 is a developer board embedded ATMEL SAMD21 as a microcontroller designed to integrate low power consumption and high performance. The MKRFOX1200 delivers Arduino Zero functionality in a smaller form factor defined by the Arduino MKR1000 adding SigFox connectivity to the Arduino platform.



Picture 4. Arduino MKR Vidor 4000

Arduino MKR Vidor 4000 is a new type of board from the MKR family which includes the most powerful reprogrammable chip, the FPGA, and the Microchip SAMD21 microcontroller.

In this test, I want to show you how to use the RTC library method to do something when the alarm matches. Specifically, in this example, the RTC time is set at 00:34:24 and the alarm at 00:34:25. When the matching time using match type MATCH_HHMMSS is reached, the built-in interrupt function will print on the serial monitor the Alarm Match!. The flow chart for the Simple RTC Alarm program in this experiment is as follows:



Picture 5. Flowchart Simple RTC Alarm

The first instruction is to input the time printed on the quartz watch or our watch. This instruction aims to equalize the time that will be used in the program. After setting the current time, the user then sets the alarm time he wants to use. After the two input processes carried out by the user are carried out, the next step will be carried out by the Arduino MKR board. The process carried out by the Arduino MKR board begins with initializing the status of the component whether it is ready for use or not, followed by reading the RTC value that has been inputted and followed by calculating the time in the program. If the time in the program matches the alarm time entered by the user, the program will print "Alarm Match".

After testing using RTC Alarm and getting the results, then the results will be inputted in a table that has been prepared to make it easier to analyze the data obtained.

Table 1: Quistionnaire of the RTC Alarm Trial

Trial Number	Time	Alarm Set	Alarm Match	Difference Time (second)	Description
1	22:16:10	22:16:30	22:16:36.594	6,594	Match more than the specified time
2	22:17:10	22:17:30	22:17:35.074	5,074	Match more than the specified time
3	22:18:10	22:18:30	22:18:30.943	0,943	Match more than the specified time
…	…	…	…	…	…
…	…	…	…	…	…
50	23:06:10	23:06:30	23:06:27.521	-2,479	Match is less than the specified time
Average				2,912 second	

In the research results table, there are 6 columns, the first column identifies the number of experiments carried out, the Time column states the initial time to be used, the Alarm Set column identifies the time:minute: second the alarm is made, the Alarm Match column states what time:minute: second the alarm sounds or on, the Difference Time column states how many minutes or seconds the difference between when the alarm sounds and the time that has been set.

The function used to find the time difference is as follows:

$$D = AM - AS \quad (1)$$

In which, D is the time difference, AM is the matched alarm and AS is the Alarm Set.

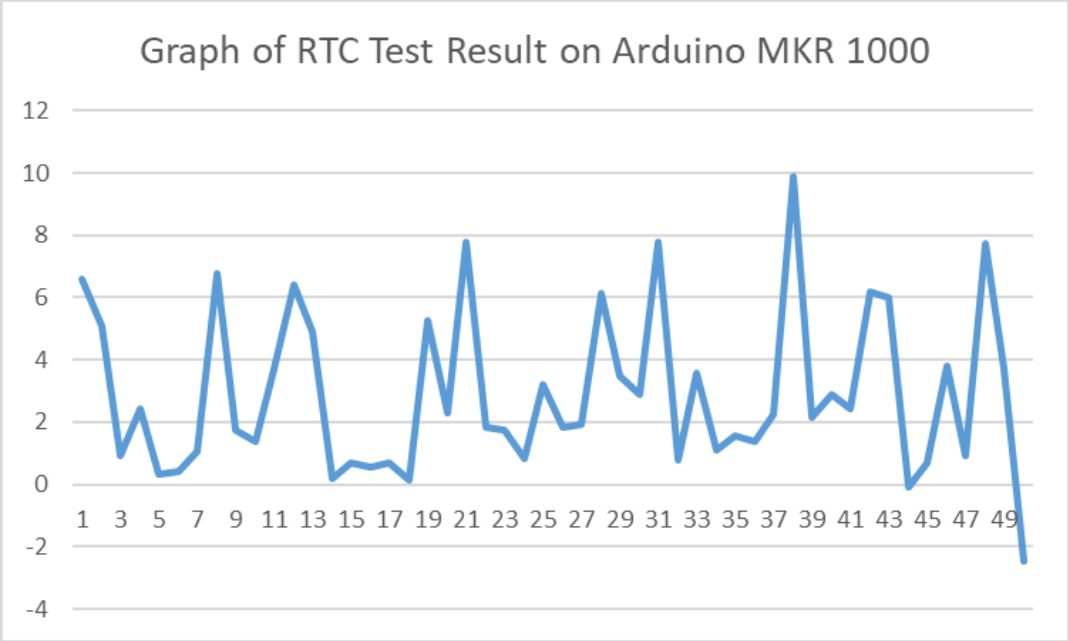
The function used to find the average difference is as follows:

$A = (D1+D2+ \dots + D50) / n$ (2)

In which, A is the mean, D is the difference and n is the number of trials.

By doing the same experiment on each Arduino MKR and on each Arduino MKR ten times, the following results are obtained which are described in a graph.

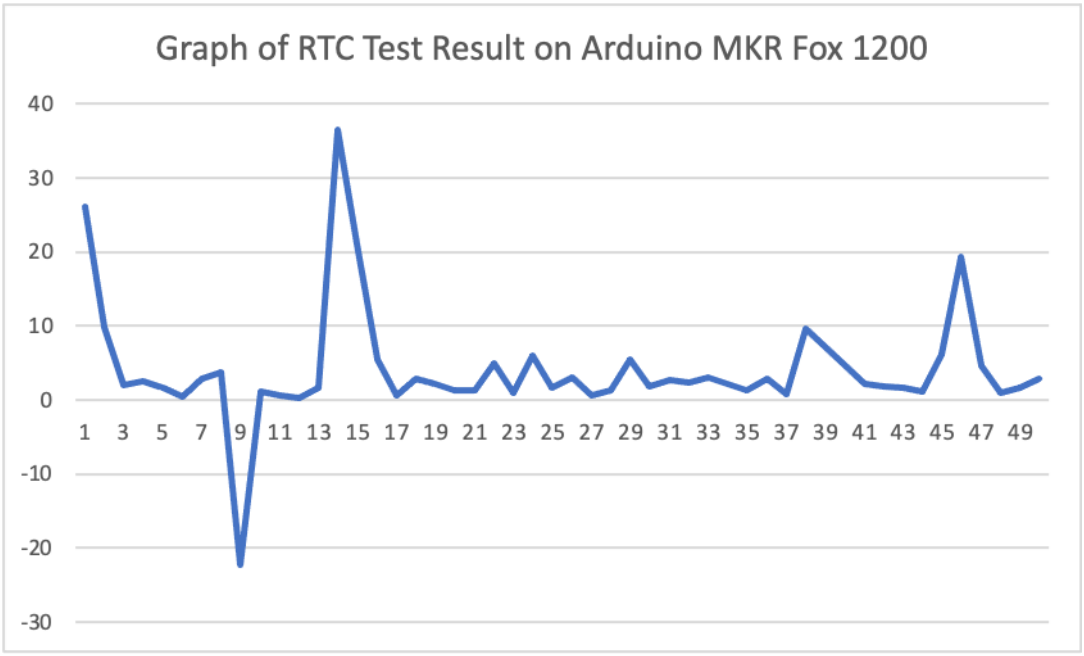
a. Arduino MKR 1000



Graph 1. Graph of RTC Test Result on Arduino MKR 1000

In the Simple RTC Alarm experiment on the Arduino MKR 1000, an average time comparison of 2.912 seconds.

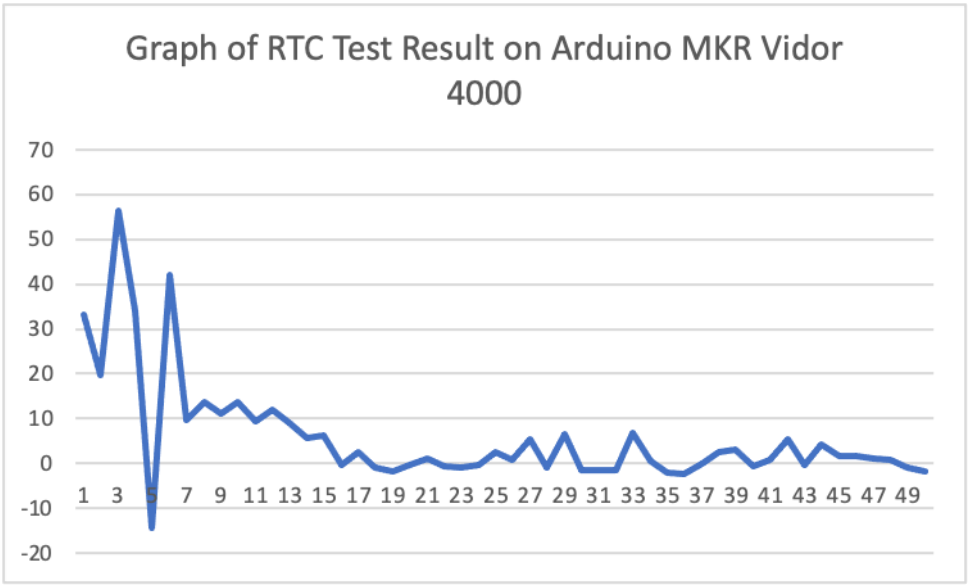
b. Arduino MKR Fox 1200



Graph 2. Graph of RTC Test Result on Arduino MKR Fox 1200

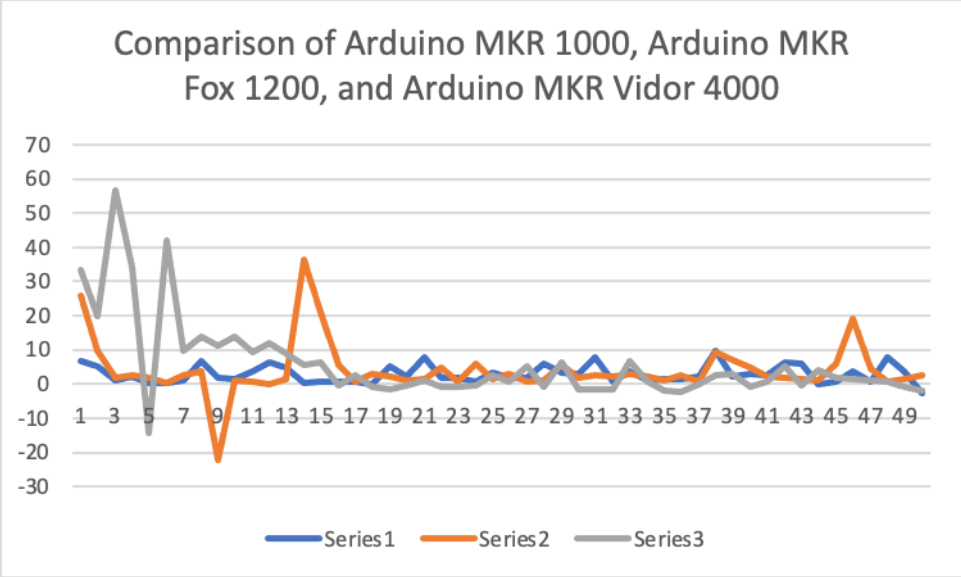
After doing 50 simple RTC Alarm experiments on the Arduino MKR Fox 1200, the average time comparison was 4.097 seconds.

c. Arduino MKR Vidor 4000



Graph 3. Graph of RTC Test Result on Arduino MKR Vidor 4000

In the Simple RTC Alarm experiment on the Arduino MKR Vidor 4000, the average time comparison was 5.804 seconds after doing 50 experiments.



Graph 4. Comparison of Arduino MKR 1000, Arduino MKR Fox 1200, and Arduino MKR Vidor 4000

4. CONCLUSION

After the researchers measured the comparison of the three MKRs using one of the projects, namely RTC (Real Time Clock). The time difference generated by each MKR is different. Likewise, the difference in time each time the experiment was carried out on one MKR. The average time difference for each MKR indicates IC capability and MKR accuracy. From the experimental results, the average MKR 1000 has the smallest time difference of 2,912 seconds compared to the MKR Fox 1200 with an average time difference of 4,097 seconds and the MKR Vidor 4000 has an average time difference of 5,804 seconds. For projects that use RTC (Real Time Clock), it is recommended to use MKR 1000.

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