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Desaign of Converter Hijri Calendar to Ad Calendar for Determaning Islamic Great Days Using Matlab

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Abstracts

This research is motivated by the importance of knowing an Islamic great day calendar on AD calendar. It was intended to answer the question: How to design converter Hijri calendar to AD calendar for determining Islamic great days using Matlab? The research used 'design' method, because it was one of activities to translate the result of analysis to software form and also used to develop an existing application. This application made by a Matlab software. Matlab was a conversion tool to determine Islamic great days. Data of this research was obtained from questionnaire. And all the questionnaire datum was used to design application. The technique of feasibility analysis application was obtained from a validation. It was using *black-box* method. The result showed that the application was made by three ways: First, making an appearance in GUI Matlab appropriate with interface design application. Second, entering the script in each menu of application. Third, entering JD formula in application that were already functioning. ©2016 JNSMR UIN Walisongo. All rights reserved.

Key words: Matlab; Converter; AD Calendar; Hijri Calendar.

1. Introduction

In this decade, the number theory became a development basis of several branches of mathematics study, such as cryptography (hieroglyph or password), calendar, and computer science [1]. This research used number theory concept to determine various dating systems [2,3]. The concept used divisibility and congruence. Human needed a date or calendar in life. As the definition of dating was an unit of time measurement used by human to record significant or historical events, even in human life or surrounding environment [4]. The unit of time measurement were days, weeks, months, years, and etc. For Moslem, calendar was an important requirement. Therefore, calendar system was also urgently needed, because time can be known currently and simply. Based on questionnaires result, it found that: 1) 100% of math students needed a calendar. 65% of them

could plan their activities, 6% knew a date, and 5% knew days off, and 55% of them were not able to practice properly. 2) Most of math students did not know that mathematical number theory could be applied for calendar calculation. 3) From the various software they studied, most of them only used Matlab to create learning media. 4) Most of students never used the applications to determine Islamic great days. 15% of students used the application to find out the Islamic great days felt difficultly. Because, the apps poorly understood by user who did not understand astronomy science and the apps also was not simple.

In addition, calendar to determine moon seen (*ru'yah*) and moon calculation (*hisab*) debate [5], along with knowledge development and technological progress was a variety tools. According both of them or other methods, there were many applications to determine calendar system that had created, such as Accurate Hijri Calculator (application to specify Hijri-AD month and to determine prayer time in several countries), Stellium (application to determine BC year by knowing weather and moon location), and Accurate Time (application to determine new moon position and prayer time. This tools were created to facilitate human in determining a calendar. The calendar was created by a computer. The computer was controlled by set of instructions it was called by program. This research used the application which made by a computer program, known by Matlab [6,7], to load the calendar system.

2. Desaign of Converter Hijri Calendar

Analysis of User Needs

Calendar is important especially for math education students and generally for moslem. It also can be called that the calendar calculation is not only needs but also obligation, because by knowing calendar calculation, moslem be able to know: 1) the appointment time of obligatory worship, such as Ramadlan fasting, forbidden fasting time, hajj time, and forbidden war time. 2) the appointment time of optional (sunnah) and treatment (mubah) worship, such as recommendation of Muharram fasting at 9 and 10, compensation for orphan, Muhammad prophet birth anniversary or usually called by 'Maulid Nabi', isra' and mi'raj anniversary, and nuzulul qur'an anniversary[8].

Design 'Converter Calendar' Application

1. Implementation of 'Calendar Converter' Application Code
   Implementation of the application code is made after a known algorithm application creation. The Figure 1, Figure 2, Figure 3, and Figure 4 are the implementation of the code of applications code that created with Flowchart.
2. Step Incorporate Apps 'Script'
 a. Insert the 'script' on the button Conversion. Write the 'script' in the buttom 'Function Konversi_Callback', by input the following 'script':

```
InputTanggal =
str2double(get(handles.InputTanggal, 'string'));
InputBulan =
str2double(get(handles.InputBulan,'string'));
InputTahun =
str2double(get(handles.InputTahun,'string'));
TahunHijriah=InputTahun-1;
NomerTahunHijriah=fix(TahunHijriah/30);
SisaTahunHijriah= TahunHijriah-
(NomerTahunHijriah*30);
HariHijriah=NomerTahunHijriah*10631;
if  SisaTahunHijriah < 2
   KabisatHijriah=0;
 else if SisaTahunHijriah < 5
  KabisatHijriah=1;
 else if SisaTahunHijriah < 7
  KabisatHijriah=2;
 else if SisaTahunHijriah < 10
   KabisatHijriah=3;
 else if SisaTahunHijriah < 13
   KabisatHijriah=4;
 else if SisaTahunHijriah < 16
   KabisatHijriah=5;
 else if SisaTahunHijriah < 18
   KabisatHijriah=6;
 else if SisaTahunHijriah < 21
   KabisatHijriah=7;
 else if SisaTahunHijriah < 24
   KabisatHijriah=8;
 else if SisaTahunHijriah < 26
```

```
    KabisatHijriah=9;
else if SisaTahunHijriah < 29
    KabisatHijriah=10;
else if SisaTahunHijriah < 31
    KabisatHijriah=11;
    end
    end
    end
  end
    end
    end
    end
    end
    end
    end
    end
end
SisaHariHijriah=SisaTahunHijriah*354+KabisatH
ijriah;
if InputBulan == 1
  JumlahInputBulan=0;
else if InputBulan == 2
  JumlahInputBulan=30;
else if InputBulan==3
  JumlahInputBulan=59;
else if InputBulan==4
  JumlahInputBulan=89;
else if InputBulan==5
  JumlahInputBulan=118;
else if InputBulan==6
  JumlahInputBulan=148;
else if InputBulan==7
  JumlahInputBulan=177;
else if InputBulan==8
  JumlahInputBulan=207;
else if InputBulan==9
  JumlahInputBulan=236;
else if InputBulan==10
  JumlahInputBulan=266;
else if InputBulan==11
  JumlahInputBulan=295;
else if InputBulan==12
  JumlahInputBulan=325;
    end
    end
    end
    end
    end
    end
    end
    end
    end
JumlahHijriah=HariHijriah + SisaHariHijriah +
JumlahInputBulan + InputTanggal;
```

```
JD=1948438.5+JumlahHijriah;
JD1=JD+0.5;
Z=fix(JD1);
F=JD1-Z;
AA=fix((Z-1867216.25)/36524.25);
A=Z+1+AA-fix(AA/4);
if Z<2299161
  A=Z;
end
B=A+1524;
C=fix((B-122.1)/365.25);
D=fix(365.25*C);
E=fix((B-D)/30.6001);
HasilTanggal=fix(B-D-fix(30.6001*E)+F);
set (handles.HasilTanggal,'string',
num2str(HasilTanggal));
HasilBulan=E-1;
if E==14
    HasilBulan=E-13;
else if E==15
    HasilBulan=E-13;
    end
end
set (handles.HasilBulan, 'string',num2str
(HasilBulan));
HasilTahun=C-4716;
if HasilBulan==1
    HasilTahun=C-4715;
else if HasilBulan==2
  HasilTahun=C-4715;
    end
end
set(handles.HasilTahun,'string',num2str(HasilTa
hun));
NomerHariMasehi=JD+1.5;
HasilHari= fix(mod(NomerHariMasehi,7)+1);
if HasilHari==1
  HasilHari =sprintf('Minggu');
  set (handles.HasilHari, 'string',HasilHari);
elseif HasilHari==2
    HasilHari =sprintf('Senin');
    set (handles.HasilHari, 'string',HasilHari);
elseif HasilHari==3
    HasilHari =sprintf('Selasa');
    set (handles.HasilHari, 'string',HasilHari);
elseif HasilHari==4
    HasilHari =sprintf('Rabu');
    set (handles.HasilHari, 'string',HasilHari);
elseif HasilHari==5
    HasilHari =sprintf('Kamis');
    set (handles.HasilHari, 'string',HasilHari);
elseif HasilHari==6
    HasilHari =sprintf('Jumat');
    set (handles.HasilHari, 'string',HasilHari);
```

```
elseif HasilHari==7
   HasilHari =sprintf('Sabtu');
  set (handles.HasilHari, 'string',HasilHari);
end
```
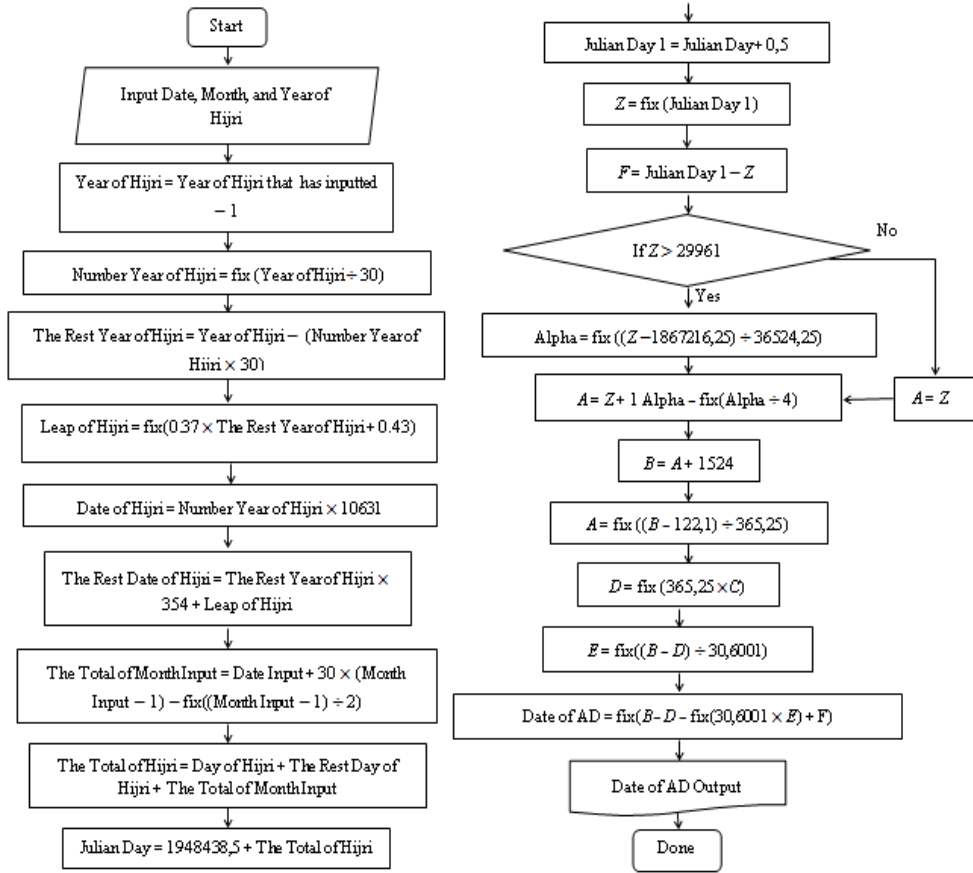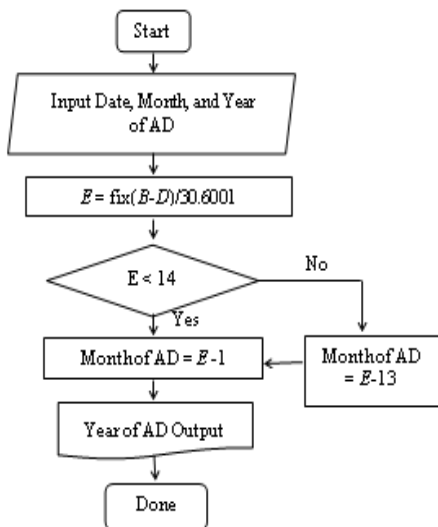

Figure 1. Date of AD Searching Flowchart

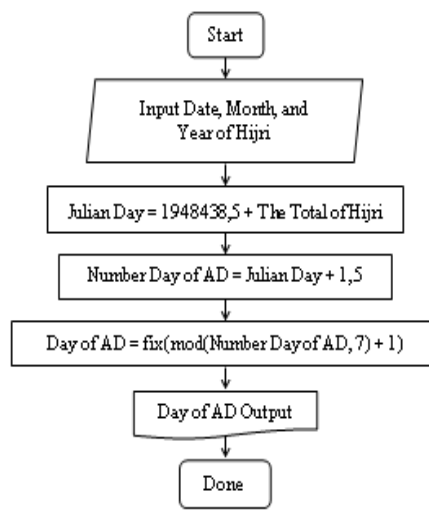**Figure 2**. Month of AD Searching Flowchart   **Figure 3**. Conversion Hijri to AD Searching Flowchart
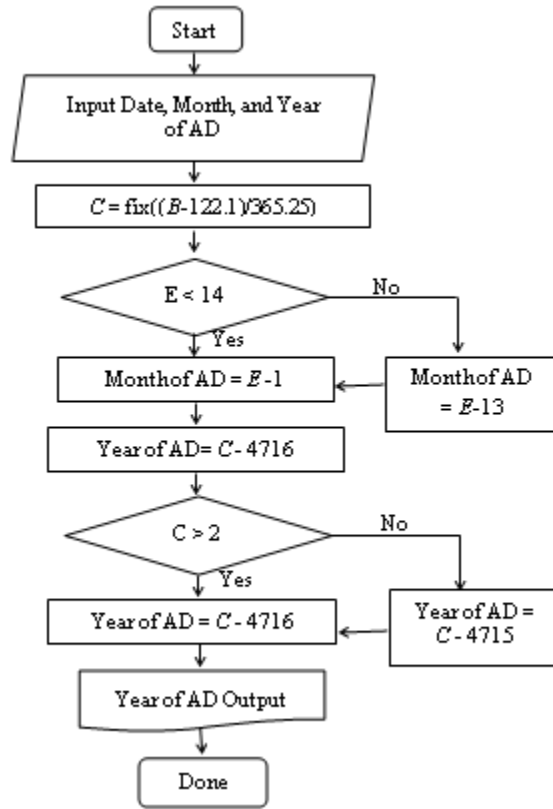
Figure 4. Year of AD Searching Flowchart

b. Insert the 'script' on the Refresh button. Write the 'script' in the buttom of 'Function Refresh_Callback', with the 'script' as follows:

set (handles.InputTannggal, 'string', '');
set (handles.InputBulan, 'string', '');
set (handles.InputTahun, 'string', '');
set (handles.HasilHari, 'string', '');
set (handles.HasilTanggal, 'string', '');
set (handles.HasilBulan, 'string', '');
set (handles.HasilTahun, 'string', '');

c. Insert the 'script' on the Close button. Write the 'script' in the buttom 'Function Refresh_Callback', with the 'script' as follows:

close;

d. Insert the 'script' on the '?' button. Write the 'script' under 'Function Catatan_Callback', with the 'script' as follows:

response = Notes;
if Close

close (handles, response);

The Results of 'Calendar Converter' Application

The Figure 5 is the final results of 'Calendar Converter' applications.

Figure 5. The Final Results Display of 'Calendar Converter' Applications

Testing 'Converter Calendar' Applications

The test results obtained from the two stages, those are 1) Test results conducted by comparing between the applications that made to the schedule of Islamic great days and that decided by the Ministry of Religion, namely Muharram, Ramadan, Eid al-Fitr and Eid al-

Adha, the results shown in the Table 1, 2) Test result conducted comparison of the predicted 5 years, starting in 1442 H, the results shown in the Table 2.

Table 1. The Test Result Applications o Islamic Great Days and Ministry Religion Schedule since 1427 to 1431 Hijri

No.	Year	Great Day of Islam	According to Ministry of Religion Calendar	Date Converter
1.	1427	1 Muharram	Tuesday, 31 of January 2006	Suitable
		1 Ramadlan	Monday, 24 of September 2006	Suitable
		I Syawal	Tuesday, 24 October 2006	Suitable
		10 Dzulhijjah	Monday, 31 December 2006	Suitable
2.	1428	1 Muharram	Saturday, 21 January 2007	Saturday, 20 January 2007
		1 Ramadlan	Thursday, 13 September 2007	Suitable
		I Syawal	Saturday, 13 October 2007	Suitable
		10 Dzulhijjah	Thursday, 20 December 2007	Suitable
3.	1429	1 Muharram	Wednesday, 10 January 2008	Suitable
		1 Ramadlan	Monday, 1 September 2008	Tuesday, 2 September 2008
		I Syawal	Wednesday, 1 October 2008	Suitable
		10 Dzulhijjah	Monday, 8 December 2008	Tuesday, 9 December 2008
4.	1430	1 Muharram	Monday, 29 December 2008	Suitable
		1 Ramadlan	Friday, 22 August 2009	Suitable
		I Syawal	Sunday, 20 September 2009	Monday, 21 September 2009
		10 Dzulhijjah	Friday, 27 November 2009	Saturday, 28 November 2009
5.	1431	1 Muharram	Friday, 18 December 2009	Suitable
		1 Ramadlan	Thursday, 11 August 2010	Suitable
		I Syawal	Friday, 10 September 2010	Suitable
		10 Dzulhijjah	Wednesday, 17 November 2010	Suitable

Table 2. The Test Result Conducted Comparison of the Predicted 5 Years Later

No.	Year	The Number of Great Day of Islam	NASA Calendar	Predicted of Ministry Religion Calendar	Date Converter
1.	1442	1 Muharram	Wednesday, 19 August 2020	Wednesday, 20 August 2020	Suitable
		1 Ramadlan	Monday, 12 April 2021	Tuesday, 13 April 2021	Suitable
		I Syawal	Wednesday, 12 May 2021	Thursday, 13 May 2021	Suitable
		1 Dzulhijjah	Saturday, 10 July 2021	Sunday, 11 July 2021	Suitable
2.	1443	1 Muharram	Sunday, 8 August 2021	Tuesday, 10 August 2021	Suitable
		1 Ramadlan	Friday, 1 April 2022	Saturday, 2 April 2022	Sunday, 3 April 2022
		I Syawal	Sunday, 1 May 2022	Monday, 2 May 2022	Tuesday, 3 May 2022
		1 Dzulhijjah	Wednesday, 29 June 2022	Friday, 1 July 2022	Suitable
3.	1444	1 Muharram	Friday, 29 July 2022	Saturday, 30 July 2022	Suitable
		1 Ramadlan	Wednesday, 22 March 2023	Thursday, 23 March 2023	Suitable
		I Syawal	Thursday, 20 April 2023	Saturday, 22 April 2023	Suitable
		1 Dzulhijjah	Sunday, 18 June 2023	Tuesday, 20 June 2023	Suitable
4.	1445	1 Muharram	Tuesday, 18 July 2023	Wednesday, 19 July 2023	Suitable
		1 Ramadlan	Sunday, 10 March 2024	Tuesday, 12 March 2024	Monday, 11 March 2024
		I Syawal	Tuesday, 9 April 2024	Wednesday, 10 April 2024	Suitable
		1 Dzulhijjah	Friday, 7 June 2024	Saturday, 8 June 2024	Suitable
5.	1446	1 Muharram	Thursday, 4 July 2024	Sunday, 7 July 2024	Monday, 8 July 2024
		1 Ramadlan	Friday, 28 February 2025	Saturday, 1 March 2025	Suitable
		I Syawal	Saturday, 29 March 2025	Monday, 31 March 2025	Suitable
		1 Dzulhijjah	Tuesday, 27 May 2025	Thursday, 29 May 2025	Suitable

Validation 'Calendar Converter' Application
   The Table 3 is the test case to validate the application using black-box.

Table 3. Black-box Validation Result Application

No.	Application Unit	Design Process	The Expected Result	Notes
1.	Data of Input Menu Hijri Calendar	Click Date Menu	Date Selection Number Display	Accordance
		Click Month Menu	Month Selection Number Display	Accordance
		Write Year Menu Wanted	Year Selection Number Display	Accordance
2.	Process Menu	Click Conversion Button	Data Result of AD Calendar Display	Accordance
3.	AD Calendar Result Menu	Click Conversion Button	Day Result Display	Accordance
		Click Conversion Button	Date Result Display	Accordance
		Click Conversion Button	Month Result Display	Accordance
		Click Conversion Button	Year Result Display	Accordance
4.	Delete Menu	Click Delete Button	Deleting Year Data of Hijri Calendar and data results of AD Calendar	Accordance
5.	Close Menu Apps	Click Close Button	The Application is Closed	Accordance
6.	Menu '?'	Click '?'Button	List of Hijri and AD Calendar Number Display	Accordance

3. Conclusion

This application was made by: *First*, making an appearance in GUI Matlab appropriate with the application interface design. *Second*, entering the script on each menu of application. *Third*, entering the JD formula on applications that were already functioning. Then, the application was ready to use by this way: input date, month, and year of Hijri calendar in input menu. And the output result of it was day, date, month, and year of AD calendar.

Acknowledgment

References

[1] R. Anugraha, *Mekanika Benda Langit*. Yogyakarta: Lab. Fisika Material dan Instrumentasi Jurusan Fisika FMIPA UGM. 2012.

[2] A.H. Fathani, *Hakikat Matematika dan Logika*. Jogjakarta: Ar-Ruzz Media. 2009.

[3] E. Utami, et al. *10 Langkah Belajar Logika dan Algoritma Menggunakan Bahasa C dan C++ di GNU/LINUX*. Yogyakarta: Andi Offset,2005.

[4] S. Azhari, *Ensiklopedi Hisab Ru'yah*. Yogyakarta: Pustaka Pelajar. Type-2. 2008.

[5] _____. *Menimbang Kalender Islam dan Masehi. http://rinto.staff.ugm.ac.id*. access at 14th of February 2016.

[6] M. Arhami, *Pemograman MATLAB*. Yogyakarta: Andi Offset, 2005.

[7] G.A. Away, *The Shortcut of MATLAB Programming*. Bandung: Informatika. 2014.

[8] Depertemen Agama RI. *Al-Qur'an dan Terjemahnya*. Bekasi: Cipta Bagus Segara. 2012.