IRSYADUL MURID HISAB OF THE BEGINNING ISLAMIC LUNAR MONTH ON DIGITAL FALAK WEB-BASED

Iqnaul Umam Ashidiqi
UIN Walisongo Semarang
Jl. Walisongo No.3-5, Tambakaji, Kec. Ngaliyan, Kota Semarang,
Jawa Tengah 50185 e-mail: Iqnaumam72@gmail.com

Abstract
The development of astronomy in determining the beginning of the Islamic lunar month has occurred so rapidly, along with the sophistication of technology that makes it easy for users to get information. The digital falak web-based application was made by Ahmad TholhabMa’ruf an astronomy scholar from Islamic boarding school who presented the astronomy books. This web-based application displayed data and calculations in several books of astronomy inclusion including IrsyadulMuridbook. The research method used was qualitative with descriptive approach. The type of data used was library research. The results showed that the algorithm used in the early reckoning of Islamic lunar infalakweb was different toIrsyadulMuridbook. The results of calculating the book IrsyadulMurid with the digital falak web of celibacy were inappropriate which was done manually within the last 3 years making the results different. So, it could be concluded that the digital Falak web was inaccurate if it was used for rukyat data. Evaluation was necessarily needed, thus hisab(astronomical calculation) result in digital falak web-based would be equivalent to hisab in IrsyadulMuridbook.

Keywords: digital falak web, Islamic lunar month, IrsyadulMurid

INTRODUCTION
It is expected that as technology develops, science presentation advances. With the help of internet, current science is accessible through computer or mobile phone easily. According to Indonesia Internet Service Provider Association survey, more than half Indonesia population were connected to internet.

Tabel 1.1
Indonesia Internet Users Data in 20161

<table>
<thead>
<tr>
<th>Year</th>
<th>Internet User</th>
<th>Presentage 100%</th>
<th>Indonesia population</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>88 million</td>
<td>34,3%</td>
<td>256,2 million</td>
</tr>
<tr>
<td>2016</td>
<td>132,7 million</td>
<td>51,8%</td>
<td></td>
</tr>
</tbody>
</table>

1Tekno.kompas.com/amp/read/2016/10/24/15064727/2016.pengguna.internet.di.indonesia.capai.132.juta
2Accessed on Thursday on February 9, 2017 at 13.00.
Based on the table above, the number of internet users had increased from 17,5% in 2016 to 34,3% in 2014. This increase was because people were connected to internet and could access everything from it. As the result of current development, *falak* (Islamic astronomy) experts were encouraged to create instrument in order to calculate Islamic lunar year. Previously, traditional Islamic lunar year calculation tools such as *hisab* locator, *rubu’ al-Majayyaband istiwa*’ sticks were utilized. Afterwards, modern calculation tools were discovered in the form of web-based. There were numbers of application calculating the beginning month in the form of android, java and web. One of the web-based applications was digital *falak* web-based made by Ahmad TholhahMa’ruf. It presented prayer time, solar occurrence time and *hisab* (astronomical calculation) program as well as calendar and was accessible for everyone.

**LITERATURE REVIEW**

KitriSulasstri’s bachelor thesis on Study Analysis of *Irsyadul Murid* Book on *Hisab* of the Beginning Islamic Lunar Month concluded that the *Irsyadul Murid* *hisab* system and its method were contemporary way of *hisab*. Furthermore, it was scientifically proven in terms of accuracy level and could be reference in determining the beginning of lunar month. Based on Kitri’s study, it could be concluded that *Irsyadul Murid* book was modern and relevance as guidance in determining the beginning Islamic lunar month. Its accuracy level was higher than *hisabaqri* or *hisabhaqiqtahqiq*. However, KitriSulasstri’s study differed to the researcher’s discussion. The main research subject of this study was digital *falak* web-based made by Ahmad TholhahMa’ruf.

**RESEARCH PURPOSE**

There were two purposes of this study. The first purpose was exploring digital *falak* web-based *hisab* method used in determining the beginning of Islamic lunar month which was made by Ahmad TholhahMa’ruf. The second purpose was discovering the *hisab* accuracy level on determining the beginning Islamic lunar month. Therefore, the result of the study could be reference or guidance in determining the beginning Islamic lunar month for *falak* experts.

**RESEARCH METHOD**

This study employed qualitative research method as as well as descriptive evaluative approach. It also referred as library research which analyzed literature sources such as books, encyclopedia, journals, magazines and other relevance sources. Primary data source

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142 | Iqaul Umam A, *Irsyadul Murid Hisab*, hlm.141-150

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2Kitri Sulasstri, *Study Analysis of Irsyadul Murid Book on Hisab of the Beginning Islamic Lunar Month* (Skripsi: S1 Fakultas Syari’ah IAIN Walisongo Semarang, 2011) h. 74 - 75.

3*Hisab* Taqribi is *hisab* system utilizing astronomical and mathematical methods yet applies simple formula and data. Therefore, the *hisab* result would be inaccurate. Abd. Salam, Nawawi. *Ilmu Falak : Cara Praktik Menghitung Waktu Shalat* *Arah* *Kiblat* dan *Awal* *Bulan*. (Sidoarjo : Aqaba, 2006) p. 5.

4*Hisab* haqiqi tahqiqi is *hisab* system employing corrected tables, spherical geometry and more sophisticated formula than *hisab* *taqrib* *hisab* Shadiq, *Perkembangan Hisab Rukyah dan Penetapan Awal Bulan Qomariyah dalam Menuju Kesatuan Hari Raya*, (Surabaya : Bina Ilmu, 1995) p. 67.

5Qualitative research method is research method which is based on postpositive philosophy. It was intended to observe nature object which the researcher was as the key instrument. Qualitative research result highlights its significance instead of generalization. Sugiyono, *Metode Penelitian Pendidikan Pendekatan Kuantitatif, Kualitatif dan R & D*, (Bandung : Alfabeta, 2008) p. 207.


consisted of primary and secondary data. The primary data was in form of interview result towards Ahmad Tholhah Ma’ruf as the creator of digital falak web-based. Then, the secondary data was literature sources supporting the research.

**Ahmad Tholhah Ma’ruf Biography**

Ahmad Tholhah bin Ma’ruf was born on June 13, 1981 in Pasuruan. He was the second of eight children of Ma’ruf and Maslihah. He lived in Masjid Warungdowo Timur, Warungdowo, Pohjentrek, Pasuruan Province, East Java and was married to Fatimatuz Zahro. He never attended formal education as other children did. At the age 9, he learned Islamic theology from 1994 to 2003.

In 1990 to 1992, he pursued his study in Al-Falah Islamic Boarding School, Lebak, Winongan, Pasuruan province for 2 years. Then he continued his study at Tahfizul Qur’an Education Boarding School at Sampuran 01 Bungah Stress, Gresik, East Java. In order to enrich his Islamic theology, he went on to study at Al Falah Islamic Boarding School, Kediri in 1994 to 2003.

In the meantime, Ahmad Tholhah was interested in mathematics. He commenced to learn falak from his teacher, Ustadz Sulaiman from Surabaya. First, he learned how to operate Casio fx4300 calculator then Casio fx4500. He started to learn windows basic programming language in 2004 and commenced to master falak. Even though he spent his school time in non-formal education for 13 years, he was keen on technology and informatics.

Several Ahmad Tholhah Maaruf treatises were digital falak android-based, digital falak web-based, VBA/ VB6 tutorial on how to create hisab/falakby VBA (Visual Basic Application), hisabby using ephemeris method papers, Falak papers on prayer time calculation and Qibla direction and falak terms glossary. In addition, there were many his works on other fields.

**Web-Based Application**

Web-based application was application or service which run inside server and could be accessed by utilizing web server everywhere through internet. Web-based application which was inside the website only could be accessed if the website was launched. In addition, website was a software coded in programming language, so it supported web-based software for instance HTML, JavaScript, CSS, Ruby, Python, PHP, Java and other programming languages.

A regular website was constructed on several connected webs. The connection between one to another website was identified as hyperlink while connector texts was called hypertext. Initially, web was information space in the internet, by means of hypertext technology, which users were directed to seek information by following available link inside the web document. The web presented on web browser.

Website was coined by Sir Timothy John, Tim Berners-Lee. In 2992, websites were connected to network. Then in 1993, Tim Berners-Lee and European Particle Physics Lab (Conseil Europeen pour la Recerche Nucleaire (CERN)) researchers in Geneva, Swiss, developed one way to share data among their coworkers by using hypertext. CERN users...
could display document on screen by operating new browser software.

At the same time in 1993, National Center for Supercomputer Applications (NCSA) launched a Graphical User Interface (GUI) which was called as Mosaic. Mosaic started to load picture which was equipped by audio or video link. As consequences, web became the most well-known media. In 1994, Mosaic established Netscape Communication Corporation named Netscape Navigator. Then, it was followed by the advent of Microsoft Internet Explorer by Microsoft. On the contrary, in 1997, NSCA decided to withdraw the Mosaic development yet chose to work on other internet technology field.

Digital Falak Web-Based

Digital Falak was one of web-based applications created by Ahmad Thohah Ma'ruf. It was created in 2015 after its android application launching and became first Falak web-based application. It was found inside the web several interfaces which were fruitful to support Falak needs for instances prayer time, hisab, and calendar.

Picture 1.1: Digital Falak

The Algorithm Analysis of the Beginning Islamic Lunar Month in Digital Falak Web-Based Based on Irsyadul Murid Book

The Algorithm used for calculating the beginning Islamic lunar month in digital Falak web-based was analogous with Irsyadul Murid's algorithm. As Ahmad Thohah Ma'ruf used Irsyadul Murid's formula, he expected that the hisab result would be equivalent. Although he employed particular codes in order to add in PHP program language, the calculation reference was taken from Irsyadul Murid Book.

Nonetheless the researcher conducted the study on the algorithm of the beginning Islamic lunar month between digital Falak web-based and Irsyadul Murid Book. The researcher discovered different formula used as the following;

1. The rationality of Common Era (C.E) month which was caused Ijtima’ (new month)

In Irsyadul Murid Book, the following is the formula used in order to attain C.E month which was Ijtima’ caused Ijtima18

18Ijtima or iqtiran symbolizes “together or collection” which is the position month and sun are in the same astronomical longitude. Muhyidin Khazin, Kamus Ilmu Falak, (Jogjakarta: Buana Pustaka, 2005) p. 32

16M. Suyanto, Multimedia AlatUntukMeningkatkanKeunggulanBersaing,.............. p. 46.
17M. Suyanto, Multimedia AlatUntukMeningkatkanKeunggulanBersaing,............ p. 46.
If $E$ minus 1 would result C.E month which was caused Ijtima’. On the contrary, in PHP program code of IrsyadulMurid book used the following formula:


Based on the formula above, attaining C.E month which was generated Ijtima’ required certain E score. If E score was smaller than 13.5, C.E month would be E-1. Then, if E score was bigger than 13.5, C.E month would be E-13. As the result, it could be assumed that PHP program code of IrsyadulMurid book was more comprehensive than IrsyadulMurid book’s explanation. In Astronomical Algorithms of Jean Meeus, C.E month which generated Ijtima’ should employed the rationality by considering E score.

2. JD Calculation of GhurubTaqribi (Sunset Calculation Approach)

In IrsyadulMurid book, after recognizing the Ijtima’, the next step was calculating the sun ephemeris data on ghurubtaqribi time at 6 p.m. local time. The calculation of sun ephemeris data on ghurubtaqribi time required JD data of ghurubtaqribi time, 18 hours behind the local time. IrsyadulMurid book used the following formula:

$$BLN = E - 1$$

However, PHP program code of IryadulMurid employed the following formula:

$$SJ1 = intval(365.25 * ($thnI + 4716)) + intval(30.6001 * (SblnI + 1)) + STGL[1] + $B2$$

In sum, the JD calculation of ghurubtaqribi of IrsyadulMurid book used 0 GMT. Likewise, IrsyadulMurid book stated different justification, 18 hours behind local time. Therefore, there was different calculation result between sun ephemeris data and ghurubtaqribi time. Comparing with other justifications of ghurubtaqribi time, Falak Practice, Hisab Method-Rukyat Practice by Ahmad Izzuddin and Solution and Falak in Theories and Practice by Muhyidin Khazin, sun ephemeris of ghurubtaqribi data used was 18 hours behind the local time. Hence, 18 hours behind the local time was the closest to ghurub.

3. The Calculation of GhurubTaqribi

On ghurubtaqribi calculation process series, the difference between IrsyadulMurid book and PHP program code of IrsyadulMurid was not only on JD calculation but also on ghurubtaqribi time calculation. In IrsyadulMurid book, sun’s angle calculation at ghurubtaqribi used the following formula:

$$JD = Int (365.25 x (Y + 4716)) + Int (30.6001 x (M + 1)) + Tgl + B + (18 - TZ) : 24 - 1524.5$$


On the other side, PHP program code of *IrsyadurMurid* used the following formula:

\[
\begin{align*}
\text{Dip} &= (1.76/60) \times \sqrt{TT} (0) \\
\text{h} &= -(s.d + 34.5' + \text{Dip}) \\
\text{t} &= \cos^{-1} (-\tan \phi \times \tan \delta \\
&\quad + \sin h / \cos \phi / \cos \delta) \\
\text{Ghurub} &= t / 15 + (12 - e)
\end{align*}
\]

Based on the formula above, there were two formulas which were used in the following *ghurubtagribi* formula:

\[
\begin{align*}
\text{Ssd} &= 0.267 / (1 - 0.017 * \cos(m)) \\
\text{SDip} &= (1.76 / 60) * \sqrt{\text{STT}} \\
\text{Sh} &= -(\text{Ssd} + 34.5 / 60 + \text{Dip}) \\
\text{St} &= \text{facos}(-\tan(LT) * \tan(MailA) + \sin(h) / \cos(LT) / \cos(MailA)) \\
\text{Ghurub} &= \text{St} / 15 + (12 - \text{e}) - \text{STZ} \\
\text{SBQutr} &= \text{fasin}(/ \sin(LT) * \sin(MailA)) \\
\text{SAMutlq} &= \text{fasin}(\cos(LT) * \cos(MailA)) \\
\text{Ghurub} &= \text{facos}((-\sin(0.808) + \sin(SBQutr) / \sin(SAMutlq)) / 15 + \\
&\quad \text{getSelisihWibWis}($\text{BLN}[1], \text{STGL}[1], \text{BT}, \text{STZ}) + 12 - \text{STZ}) \\
\text{St} &= \text{facos}(-\tan(LT) * \tan(MailA) + \sin(h) / \cos(LT) / \cos(MailA)) \\
\text{Ghurub} &= \text{St} / 15 + (12 - \text{e}) - \text{STZ} \\
\text{SBQutr} &= \text{fasin}(/ \sin(LT) * \sin(MailA)) \\
\text{SAMutlq} &= \text{fasin}(\cos(LT) * \cos(MailA))
\end{align*}
\]
On the first formula, the calculation between PHP program code of ghurubtaqribi and IrsyadulMurid book were alike. Ghurub caused by time angle, was calculated by the high angle data of the sun and used Dip correction (ufuk low angle). The calculation result of ghurubtaqribi on those program code was saved on $ghurub variable. However, saved data on $ghurub variable was replaced by new calculation result data.

\[
\text{Ghurub} = \frac{\cos(-\sin(0.808) + \sin(B\text{Qutr})/\sin(A\text{Mutlq}))}{15} + \text{getSelisihWibWis}(BLN[1], STGL[1], BT, STZ) + 12 - STZ;
\]

Then, it would be translated as the following formula:

\[
\text{Cost} = -\left(\sin(0.808) + \sin(Bu'dulQutr) / \sin(AshlMutlaq)\right) \\
\text{Ghurub} = t / 15 + (TZ - BT / 15) + 12 - TZ
\]

As $ghurub variable was defined twice, saved score on #ghurub variable was the second result calculation which cost did not use h score (the high sun angle on ghurub) by considering Dip and replacing 0.808 Constanta or 0°48'28", 8". Therefore, it could be concluded.

Analysis of the Hisab Accuracy Level of the Beginning Islamic lunar month Based on IrsyadulMurid Book in Ahmad TholhahMa’ruf Digital Falak Web-Based

1. The Accuracy Level of Digital Falak Web-Based Based on IrsyadulMurid Book

Table 4.3 Ijtima’ the Beginning Ramadhan 1436 Hijria Based on Digital Falak Web-Based and IrsyadulMurid Book

To examine the hisab accuracy level of the beginning Islamic lunar month based on IrsyadulMurid book in Ahmad TholhahMa’ruf digital falak web-based, the researcher had conducted calculation starting on Ramadhan 1436 Hijria based on digital falak web-based and IrsyadulMurid book.
On digital falak web-based layout, the display day on ijtima’ line stated Tuesday night. However, Pasaran(five-day week) day should be stated on the next day, Pahing. Based on the researcher analysis, there was vague in constructing PHP program language on digital falak web-based. On month and sun azimuth row, digital falak web-based did not calculate from west instead of north in clockwise direction as azimuth justification. In addition, the data presentation basis did not employed second data yet rounded off to minute basis. As the result, both data would generate similar result. The high level of hilal was shown as (-) sign even though it was under the ufuk. Furthermore, the calculation of markaz (altitude) was quite distinct from the IrsyadulMuridbook which was 110° 24’ while digital falak web-based markaz was 110° 26’. As the result, there was quite distinct, though trivial, calculation result data.

It could be assumed that the date modification on hisab row did not affect the result of ijtima’ of the beginning Ramadhan 1436 Hijriain digital falak web-based. Consequently, users would face difficulty in seeking the high level of hilal of the beginning date for every Islamic lunar month. Then, there was one minute deviation on Ramadhan 1436 Hijriain. There was Mo (thul al-Qomar) score anomaly which was negative instead of positive. If there was mistake Thul al–Qomar(month longitude) score, Matholi’ mustaqimah li qomar(month right ascension) score would generate error result. Matholi’mustaqimah score had to be in similar quadrant. If matholi’mustaqimah was incorrect, it would affect zwiyyahzamamlilqomar (the angle time of month).

The calculation of zwiyyahzamamlilqomar by K.H Ahmad Ghozali M. Fatullah employed zamannajmi (sidereal time) equation minus matholi’ mustaqimahlilqomar score, plus thul al–balasyarqi. If zwiyyahzamamlilqomar score was incorrect, it could be assume that hilalirtifa’ would be incorrect. In addition, there was several mistakes in digital falak web-based which some months was inappropriate to pasaran on Ramadhan 1436 Hijriain. In this case, there was algorithm mistake in hisaburfi’ conversionin determining pasaran day. Auto detection of coordinate point in digital falak web-based was different to IrsyadulMuridbook. Due to advance and
sophisticated digital falak web-based, the synchronization between latitude and longitude and Google result would affect in minutes. Month period in digital falak web-based was not stated, so it should be looked by the users themselves and obscure them. Moreover, rukyab/data was not available because presented hisab date was before rukyab date/ the 29th of month.

2. Digital falak web-based application has its strengths and weaknesses. The following list was digital falak web-based strengths:
   a. It was user friendly for average people that they did not need to calculate hisab of the beginning Islamic lunar month based on IrsyadulMurid book for hours. However, users should select the calculation according to their need. It could be either the final result of hisabijtim has or comprehensive result of hisabijtim has.
   b. It was user friendly that could be accessed anytime and anywhere without installing it first.
   c. Digital falak web-based could be operated by any operation systems such as Linux or Windows as long as having web browser and internet connection.
   d. Digital falak web-based use .com domain whose stood for commercial. This domain extension was intended for commercial for instances personal or corporate blog/website. It was well-known, international-scale, extension domain which captivate web visitors. Auto detection of location used had been synchronized by Google in order to get high accuracy level of latitude and longitude based on particular city which users inserted.

Besides its strength, digital falak web-based had several weaknesses such as:
   a. It required steady internet connection so users could access it.
   b. On date column, it did not work well and users could not inserted based on their needs.

CONCLUSION

Based on analysis and discussion above, the researcher could concluded as follows:

1. There was distinct algorithm and formula used between digital falak web-based and IrsyadulMurid book. They were Gregorian month logic of Ijtim’ occurrence, JD calculation of ghurubtaqribi and calculation of ghurubtaqribi. Due to this differences, it would affect the result of hisab of the beginning Islamic lunar month.

2. Data rukyab was unavailable because it presented rukyab date was before rukyab date/ the 29th of month. This design flaw caused imprecise of accuracy level in digital falak web-based application.

SUGGESTIONS

The urge of upgraded version of digital falak web-based would be necessarily needed in order to maintain the accuracy level as in IrsyadulMurid book. It was undeniable that IrsyadulMurid book was including contemporary book as Ephemeris and Jean Meeus. Therefore, there was no difference use in digital falak web-based application. In addition, it was necessary to develop digital falak web-based based on several falak books so it could enriching falak science. Development of falak in determining the beginning Islamic lunar month should be fostered. Hence Ministry of religion should appreciate falak experts’ works.
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Interview:

Interview result with Ahmad Tholhah bin Ma’ruf on Friday, 07 April 2017 in Masjid Warungdowo Timur, Warungdowo, Pohjentrek, Pasuruan Province, East Java at 09.00.

Website: