

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

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### **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 TholbahMa'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 in IrsyadulMuridbook based on the digital falak web was different to IrsyadulMuridbook. The results of calculating the book IrsyadulMuridwith 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 2016<sup>1</sup>

Year	Internet User	Presentage 100%	Indonesia population
2014	88 million	34,3%	256,2 million
2016	132,7 million	51,8%	

<sup>1</sup>[Tekno.kompas.com/amp/read/2016/10/24/15064727/2016.pengguna.internet.di.indonesia.capai.132.juta](http://Tekno.kompas.com/amp/read/2016/10/24/15064727/2016.pengguna.internet.di.indonesia.capai.132.juta). Accessed on Thursday on February 9, 2017 at 13.00.

Source: [Tekno.kompas.com/amp/read/2016/10/24/15064727/2016.pengguna.internet.di.indonesia.capai.132.juta](http://Tekno.kompas.com/amp/read/2016/10/24/15064727/2016.pengguna.internet.di.indonesia.capai.132.juta).

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 *hila* locator, *rubu' al-Mujayyab* and *istiva'* 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

KitriSulastri's bachelor thesis on Study Analysis of *IryadulMurid* Book on *Hisab* of the Beginning Islamic Lunar Month concluded that the *IryadulMuridhisab* system and its method were contemporary way of *hisab*<sup>2</sup>. 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 *IryadulMurid* book was modern and relevance as guidance in determining the beginning Islamic lunar month. Its accuracy level was higher than *hisabtaqribi*<sup>3</sup> or *hisabhaqiqitahqiqi*<sup>4</sup>. However,

<sup>2</sup>Kitri Sulastri., *Study Analysis of Iryadul Murid Book on Hisab of the Beginning Islamic Lunar Month* (Skripsi: S1 Fakultas Syari'ah IAIN Walisosng Semarang, 2011) h. 74 - 75.

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

<sup>4</sup>Hisab haqiqi tahqiqi is *hisab* system employing corrected tables, spherical geometry and more sophisticated formula than *haqiqitakribi* hisab Sriyatin Shadiq, *Perkembangan Hisab Rukyah*

KitriSulastri'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<sup>5</sup> as well as descriptive<sup>6</sup> evaluative<sup>7</sup> approach. It also referred as library research which analyzed literature sources such as books, encyclopedia, journals, magazines and other relevance sources<sup>8</sup>. Primary data source

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dan Penetapan Awal Bulan Qomariyah dalam Menuju Kesatuan Hari Raya, (Surabaya : Bina Ilmu, 1995) p. 67.

<sup>5</sup>Qualitative 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.

<sup>6</sup>Descriptive research is methodical, factual and accurate description of phenomenon or relationship among observable phenomena. Imam Suprayogo dan Tobroni, *Metodologi Penelitian Sosial-Agama*, (Bandung: PT Remaja Rosda Karya, 2001) p. 136 - 137.

<sup>7</sup>Evaluative approach is collecting policy implementation. Suharsimi Arikunto, *Prosedur Penelitian: Suatu Pendekatan Praktik*, (Jakarta: Rineka Cipta, 2010) p. 37.

<sup>8</sup>Soerjono Sokanto dan Sri Mamudji, *Penelitian Hukum Normatif Suatu Tinjauan Singkat*, (Jakarta: Rajawali, 1986) h. 15.

consisted of primary and secondary data<sup>9</sup>. The primary data was in form of interview result towards Ahmad TholhahMa'ruf as the creator of digital *falak* web-based<sup>10</sup>. Then, the secondary data was literature sources supporting the research.

### Ahmad TholhahMa'rufBiography

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 FatimatuzZahro. 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.<sup>11</sup>

Several Ahmad Tholhah Maruf treatises were digital *falak* android-based, digital *falak* web-based, VBA/VB6 tutorial on how to create *hisab/falak* by 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<sup>12</sup>. 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<sup>13</sup>.

Website was coined by Sir Timothy John, Tim Berners-Lee. In 1992, websites were connected to network. Then in 1993, Tim Berners-Lee and European Particle Physics Lab (Conseil Européen pour la Recherche Nucléaire (CERN)) researchers in Geneva, Swiss<sup>14</sup>, developed one way to share data among their coworkers by using hypertext. CERN users

<sup>9</sup>Jusuf Soewadji, *Pengantar Metodologi Penelitian*, (Jakarta: Mitra Wacana Media, 2012) h. 91.

<sup>10</sup>Imam Gunawan, *Metode Penelitian Kualitatif Teori dan Praktek*, (Jakarta : PT. Bumi Aksara, 2013) h. 162.

<sup>11</sup>Interview with Bpk. Ahmad Tholhah bin Ma'ruf on Friday, 07 April 2017 at Masjid Warungdowo Timur, Warungdowo, Pohjentrek, Pasuruan Province, East Java at 09.00.

<sup>12</sup>Yuhfizer, S. Kom, dkk, *Cara Mudah Membangun Website Interaktif Menggunakan Content Management System Joomla (CMS) Edisi Revisi*, (Jakarta: PT. Elex Media Komputindo) p. 2.

<sup>13</sup>Betha Sidik dan Husni Iskandar Pohan, *Pemrograman WEB dengan HTML Revisi Kelima*, (Bandung : Informatika, 2014) p. 1.

<sup>14</sup>M.Suyanto, *Multimedia Alat Untuk Meningkatkan Keunggulan Bersaing*, (Yogyakarta : Andi, 2003) p. 45.

could display document on screen by operating new browser software<sup>15</sup>.

At the same time in 1993, National Center for Supercomputer Applications (NCSA) launched a Graphical User Interface (FUI) 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<sup>16</sup>. 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<sup>17</sup>.

**Digital Falak Web-Based**

Digital*falak* was one of web-based applications created by Ahmad TholhahMa’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*



Source: <https://www.digitalfalak.com/>

**The Algorithm Analysis of the Beginning Islamic Lunar Month in Digital Falak Web-Based Based on IryadulMuridBook**

The Algorithm used for calculating the beginning Islamic lunar month in digital *falak* web-based was analogous with *IryadulMurid's* algorithm. As Ahmad ThohahMa’ruf used *IryadulMuridhisab* 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 *IryadulMuridbook*.

Nonetheless the researcher conducted the study on the algorithm of the beginning Islamic lunar month between digital *falak* web-based and *IryadulMuridbook*. 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 *IryadulMuridbook*, the following is the formula used in order to attain C.E month which was *Ijtima'* caused *Ijtima*<sup>18</sup>

<sup>15</sup>Betha Sidik Husni Iskandar Pohan, *Pemrograman WEB dengan HTMLRevisi Kelima*,..... p. 2.

<sup>16</sup>M.Suyanto, *Multimedia AlatUntukMeningkatkanKeunggulanBersaing*,..... p. 46.

<sup>17</sup>M.Suyanto, *Multimedia AlatUntukMeningkatkanKeunggulanBersaing*,..... p. 46.

<sup>18</sup>*Ijtima* 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

$$BLN = E - 1$$

If E minus 1 would result C.E month which was caused *Ijtima'*. On the contrary, in PHP program code of *IryadulMurid* book used the following formula:

$$SE[1] - (SE[1] < 13.5 ? 1 : 13));$$

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 *IryadulMurid* book was more comprehensive than *IryadulMurid* 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 *IryadulMurid* 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. *IryadulMurid*<sup>19</sup> book used the following formula:

$$JD = \text{Int} (365.25 \times (Y + 4716)) + \text{Int} \\ (30.6001 \times (M + 1)) + Tgl + B \\ + (18 - TZ) : 24 - 1524.5$$

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

$$JD1 = \text{intval}(365.25 * (\$thnI + \\ 4716)) + \text{intval}(30.6001 * \\ (\$blnI + 1)) + \$TGL[1] + \$B2$$

In sum, the JD calculation of *ghurubtaqribi* PHP program code of *IryadulMurid* used 0 GMT. Likewise, *IryadulMurid* 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, *FalakPractice*, *Hisab Method-Rukyat Practice* by Ahmad Izzuddin and Solution and *Falakin 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 *IryadulMurid* book and PHP program code of *IryadulMurid* was not only on JD calculation but also on *ghurubtaqribi* time calculation. In *IryadulMurid* book, sun's angle calculation at *ghurubtaqribi* used the following formula<sup>20</sup>:

<sup>19</sup>Ahmad Ghazali Muhammad Fathullah, *Iryadul Murid*, (Lanbulan :Lafal, 2005) p. 137.

<sup>20</sup>Ahmad Ghazali Muhammad Fathullah, *Iryadul Murid*, (Lanbulan :Lafal, 2005) p. 138.

$$\text{Dip} = (1.76/60) \times \sqrt{TT} \text{ (0)}$$

$$h = - (s.d + 34.5' + \text{Dip} )$$

$$t = \text{Cos}^{-1} ( -\tan \phi \times \tan \delta + \text{Sin } h / \text{Cos } \phi / \text{Cos } \delta )$$

$$\text{Ghurub} = t / 15 + (12 - e)$$

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

```
$sd = 0.267 / (1 - 0.017 * fcos($m));
$Dip = (1.76 / 60) * sqrt($TT);
$sh = -($sd + 34.5 / 60 + $Dip);
$t = facos(-ftan($LT) * ftan($MailA) + fsin($h) / fcos($LT) / fcos($MailA));
$Ghurub = $t / 15 + (12 - $e) - $TZ;
$BQutr = fasin(fsin($LT) * fsin($MailA));
$AMutlq = fasin(fcos($LT) * fcos($MailA));
$Ghurub = facos(-(fsin(0.808) + fsin($BQutr) / fsin($AMutlq))) / 15 +
    getSelisihWibWis($BLN[1], $TGL[1], $BT, $TZ) + 12 - $TZ;
```

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

$$t = \text{facos}(-\text{ftan}(\text{\$LT}) * \text{ftan}(\text{\$MailA}) + \text{fsin}(\$h) / \text{fcos}(\text{\$LT}) / \text{fcos}(\text{\$MailA}));$$

$$\text{\$Ghurub} = t / 15 + (12 - \$e) - \$TZ;$$

$$\text{\$BQutr} = \text{fasin}(\text{fsin}(\text{\$LT}) * \text{fsin}(\text{\$MailA}));$$

Also,

$$\text{\$AMutlq} = \text{fasin}(\text{fcos}(\text{\$LT}) * \text{fcos}(\text{\$MailA}));$$

```
$Ghurub = facos(-(fsin(0.808) + fsin($BQutr) / fsin($AMutlq))) / 15 +
getSelisihWibWis($BLN[1], $TGL[1], $BT, $TZ) + 12 - $TZ;
```

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

```
facos((fsin(0.808)+fsin($BQutr)/fsin($AMu
tlq)))/15+getSelisihWibWis($BLN[1],
$TGL[1], $BT, $TZ) + 12 - $TZ
```

Then, it would be translated as the following formula:

```
Cos t = -(sin(0.808) + sin($Bu'dulQutr) /
sin(AshlMutlaq))
Ghurub = t / 15 + (TZ - RT / 15) + 12 - TZ
```

As *\$ghurub* variable was defined twice, saved score on *#ghurub* variable was the second result calculation which *cos t* 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

that PHP program code of *ghurubtaqribi* calculation did not utilized Dip correction (*ufuk* low angle). In addition, there was difference in *IrsyadulMurid* book justifications which employed Dip correction in calculating *ghurubtaqribi*

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

To examine the *bisab* 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

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

Hisab Awal Bulan Ramadan Tahun 1436 H.	
Awal bulan	: Kamis Pon, 18 Jun 2015
Ijtima Terjadi Pada	: Malam Rabu Legi, 16 Jun 2015
Jam Ijtima	: 08:47 WIS   21:09 W.Setempat
Arah Hilal	: Di Utara Matahari
Posisi Hilal	: Miring ke Utara
Azimuth Matahari	: 23°24' sebelah utara titik barat
Azimuth Bulan	: 18°19' sebelah utara titik barat
Tinggi Hilal [Malam Rabu]	: -02°56'
Lama Hilal	: -00:07
Cahaya Hilal	: 0.002 Usbu
Matahari Terbenam	: 05:45 WIS   17:24 W.Setempat
Markaz	: semarang (-07°00'   110°26')

KETERANGAN	
Ijtima akhir bulan SYA'BAN 1436 terjadi pada hari Selasa Legi Tgl. 16 Juni 2015 Jam 21:8:33 LT	
Tinggi Hilal Mar'i pada hari Selasa Legi, 16 Juni 2015 masih dibawah ufuk	
Data Observasi Hilal saat Maghrib 17:30:56,7 Hari Selasa Legi, 16 Juni 2015	
Umur Hilal	-3 : -37 : -38, Jam
Tinggi Hilal Haqiqi	-1° 58' 0,85"
Tinggi Hilal Mar'i	Dibawah ufuk
Lama Hilal	0 : 0 : 0 Jam
Azimuth Hilal	288° 18' 53,8"
Azimuth Hilal dari barat	18° 18' 53,8" > U
Azimuth Matahari	293° 24' 14,4"
Azimuth Mthr dari barat	23° 24' 14,4" > U
Jarak Hilal -- Matahari	5° 5' 20,83"
Posisi Hilal	Selatan Matahari
Keadaan Hilal	Dibawah ufuk
Nurul Hilal jari	Nol jari
Nurul Hilal %	Nol persen
Ghurub Hilal Haqiqi	17 : 20 : 51,8
Terbit Hilal Haqiqi	5 : 14 : 53,3
Terbit Matahari	5 : 48 : 48,2
Jarak Bumi - Bulan	383558,39245 Km
Jarak Bumi - Matahari	151983387,22 Km

Source: <https://www.digitalfalak.com/> and *IryadulMuridbook*

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 *IryadulMuridbook* 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 *bisab* 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 Hijria. 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' mustaqimab li qomar*(month right ascension) score would generate error result. *Matholimustaqimab* and *thul* score had to be in similar quadrant. If *matholimustaqimab* was incorrect, it would affect *zawiyablilqomar* (the angle time of month). *Zaqiyabzamanlilqomar* formula by K.H Ahmad Ghozali M. Fathulloh employed *zamannajmi* (sidereal time) equation minus *motholi' mustaqimablilqomar* score, plus *thul al-balaqsyarqi*. If *zawiyabzamanlilqomar* 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 Hijria. In this case, there was algorithm mistake in *bisaburfi'* conversion in determining *pasaranday*. Auto detection of coordinate point in digital *falak* web-based was different to *IryadulMuridbook*. 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 obscured them. Moreover, *rukayah* data was not available because presented *hisab* date was before *rukayah* date/ the 29<sup>th</sup> 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 *IryadulMurid* book for hours. However, users should select the calculation according to their need. It could be either the final result of *hisabijtima'* or comprehensive result of *hisabijtima'*.
- 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.

## CONCLUSSION

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 *IryadulMurid* book. They were Gregorian month logic of *Ijtima'* 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 *rukayah* was unavailable because it presented *rukayah* date was before *rukayah* date/ the 29<sup>th</sup> 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 *IryadulMurid* book. It was undeniable that *IryadulMurid* 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 :

[Tekno.kompas.com/amp/read/2016/10/24/15064727/2016.pengguna.internet.di.indonesia.capai.132.juta](http://Tekno.kompas.com/amp/read/2016/10/24/15064727/2016.pengguna.internet.di.indonesia.capai.132.juta). accessed on Thursday 9 February 2017 at 13.00.