JCIS
Journal of Contemporary Islamic Studies

Developing IoT-Based "Saf" Straightener Monitoring System Prototype for Congregational Prayers Using Arduino as A Microcontroller

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Received: 3 December 2020
Accepted: 7 February 2021
Online First: 10 March 2021

ABSTRACT

Performing prayer five times a day such as Subuh, Zuhur, Asar, Maghrib and Isyak is a compulsory thing that Muslims need to do. One of the problems occurred during congregational prayers is to straighten the "saf". Some of the reasons why Muslims do not straighten their "saf" are they are as late for prayer in congregation, lack of knowledge about the importance of straightening "saf" during congregation prayers etc. Prophet Muhammad S.A.W did emphasized on straintening "saf" during congregational prayer because it is considered as a part of the perfection of prayer. An urgent innovation is needed in order to help all Muslims to understand better of the needs of straightening their "saf" in every prayer. This project is developed in order to build a prototype of "saf" straightening indicator that will help

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to straighten the "saf" during congregational prayers and to develop a program for monitoring "saf" alignment during congregational prayers. This prototype was built using Arduino Mega as a microcontroller, lasers and LDR as input sensors, Bluetooth as a switch and LED, LCD and buzzer as outputs. This prototype contributes to create awareness to Muslims on the importance of straightening "saf" during congregational prayers.

Keywords*: Arduino Mega, Congregational prayer, Ptototype,Saf, Straightener*

INTRODUCTION

Straightening up the "saf" is an important thing that being ignored by a handful of Muslims during congregational prayers. Many *hadiths* emphasize the importance of straightening up the "saf" during congregational prayers, among others as follows:

> *"Straightening up the saf because it is included in setting up the prayer"*
>
> (Al-Bukhari: Hadis no. 723)

> *"Straighten your saf during congregational prayer because straighten the saf is a part of the perfection of prayer"*
>
> (Muslim: Hadis no. 432)

> *"Set your saf and tie your shoulders and close the existing spaces"*
>
> (Abu Daud: Hadis no. 666)

During congregational prayers, Muslims are commanded to straighten up the "saf" and tie the adjacent shoulders and heels because all these acts have their own benefits especially from human health perspectives. However, what is worrying is that when Muslims come to the mosque to perform prayers in a state of lack of knowledge. For example, they are delaying themselves to enter the first "saf" and reluctant to straighten up the "saf" during the prayer. This attitude shows that some Muslims still think that the practise of straighten up the "saf" is a trivial matter (Salleh, 2016).

There are various benefits that could be obtained from the perspective of science and technology if the "saf" are well straightened during congregational prayers (Abu Bakar, Z & Seli, H 2015; Aziz, N.A.A, 2011). Prayer movements that involve standing upright, bowing, sitting and prostrating in an orderly and repetitive manner can be likened to light exercise (Ibrahim, F et al., 2009). Exercise therapy through proper prayer movements can restore the body's elasticity, maintain ideal body posture and help reduce back pain (Ibrahim, F. et al., 2009 & Wan Ramli, W.M, 2007).

Nowadays, it can be seen that there are a handful of Muslims do not care about the importance of straightening the "saf" during the congregational prayer. The "saf" contains gaps and feet are not in the straight line (Misri, 2011). The "saf" line is very difficult to straighten up during the commencement of congregational prayers (Salleh, 2016).The major issue of traditional way of making a straight "saf" line is using the last line of the praying mat as an indicator which is inaccurate. According to a narrative, Sayyidina Umar Al-Khattab used a sword to straighten up the "saf" during congregational prayers. It shows the importance of straightening up the "saf" before starting the prayer. **Figure 1a** and **Figure 1b** below show the right and wrong "saf" positions during the congregational prayers (Misri, 2011; Raiz, R et al., 2011).

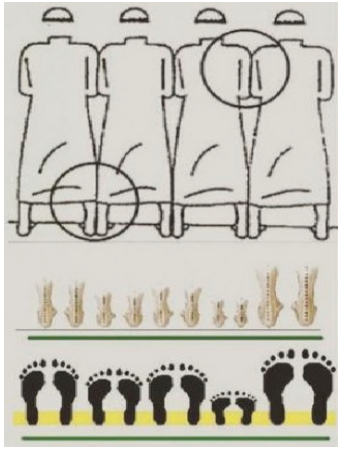

Figure 1a: Right "saf"

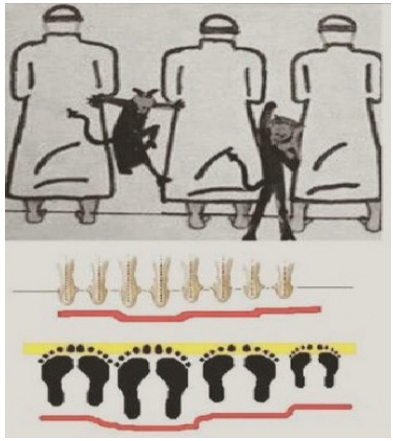

Figure 1b: Wrong "saf"

Thus, the objectives of this research are to design and construct a prototype using Arduino Mega as a microcontroller to straighten up the "saf" during the congregational prayers. Drawings and simulations of circuit and layout schematics will be executed in Proteus software. Developing the program will be executed in Arduino software using (Holvensen, 2016).

HARDWARE IMPLEMENTATION

This prototype consists of three (3) main parts which are input, microcontroller and output. It can be shown in the block diagram as shown in **Figure 2.**

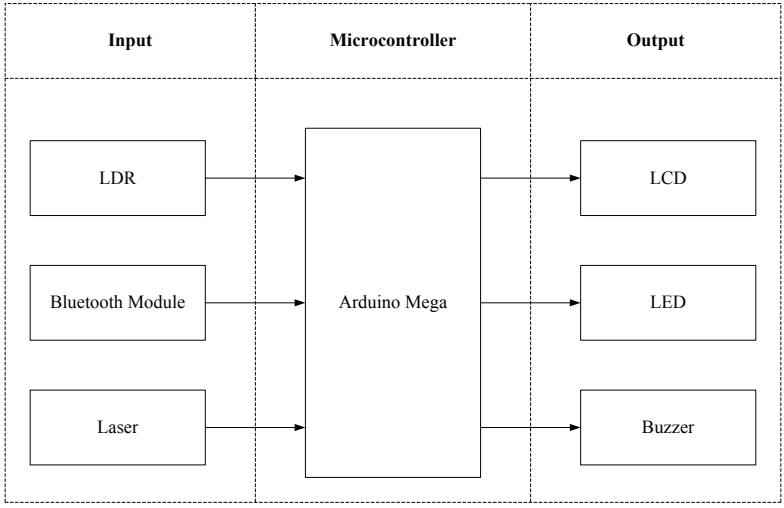

Figure 2: Block diagram of the prototype

Meanwhile, **Table 1** shows the mainly components and functions of each components used to prepare this prototype.

Table 1: Components and Functions

Component	Function
Bluetooth Module	Bluetooth Module (HC-05) is designed for transparent wireless serial connection setup and provides switching mode between master and slave mode. It can be used neither receiving nor transmitting data.
Light Detecting Resistor (LDR)	LDR is a light-controlled variable resistor. The resistance of photoresistor decreases with increasing incident light intensity. t exhibits photo conductivity. LDR can be applied in light sensitive detector circuits and light and dark activated switching circuits.
Arduino Mega	Arduino Mega is a microcontroller board that consist of 54 digital i/o pins, 16 analog pins, 4 hardware serial ports, a USB connection, a power jack, an ICSP header, a reset button and a 16 MHz crystal oscillator.
Laser	A measurement device that is used to emit light at a particular wavelength

METHODOLOGY

The main objective of this prototype is to propose model for IoT "saf" straightener monitoring system. It involved several processes in order to prepare this prototype. One of the most important processes to prepare this prototype is a Printed Circuit Board (PCB) fabrication process.

Figure 3 shows a PCB fabrication process involved in preparing this prototype. This PCB fabrication process begins with drawing the artwork and layout by using Proteus and has ended with troubleshooting process.

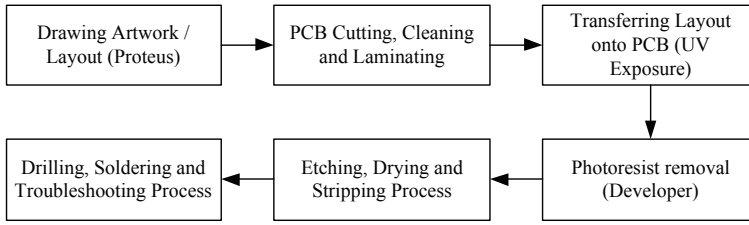

Figure 3: PCB fabrication process

Figure 4 shows the schematic diagram while **Figure 5** shows the PCB layout of this prototype that has been drawn using Proteus. The schematic diagram as shown in **Figure 4** is a collection of electronics symbols connected together with virtual "wires". The schematic diagram is important when fabricating a PCB in order to provide input to circuit layout and routing tools.

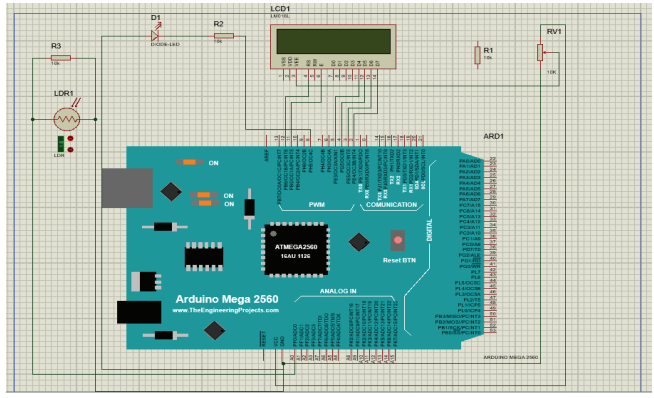

Figure 4: Schematic diagram of the prototype

Meanwhile, the layout as shown in **Figure 5** is a circuit board tool that accepts compatible circuit netlist and generate an output files that suitable for PCB fabrication.

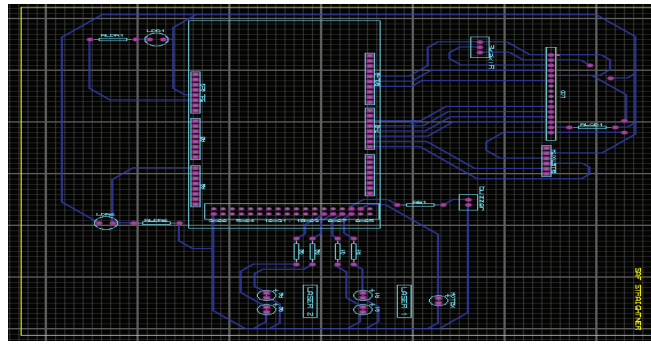

Figure 5: PCB layout of the prototype

Figure 6 shows the flowchart and the prototype operation as a whole. The system starts when the *imam* who lead the prayer will turn the Bluetooth system through his phone. When the Bluetooth system from the cell phone detects the signal from the Bluetooth Module, the yellow LED will turn on and the LCD will display "Please straighten the saf". Otherwise, the prototype is still in OFF condition. Then, the laser will be turned on. If the LDR detects diffraction from the emitted laser, the red LED will turn ON, the LCD will display "Saf is not straight" and the buzzer will produce a sound. Otherwise, green LED will light up and LCD will display "Saf is straight". When the "saf" is successfully straightened, the imam will off the "saf" monitoring system using his mobile phone.

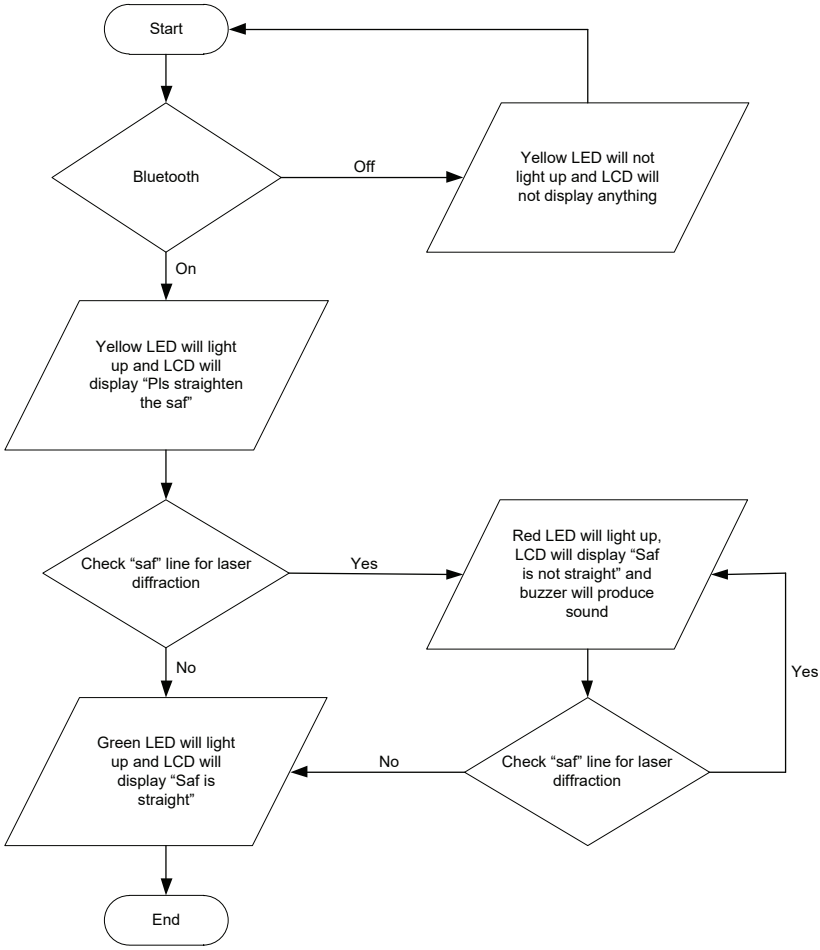

Figure 6: Flowchart of the prototype

Meanwhile, **Figure 7** to **Figure 9** show the results attained from the conducted experiments. It shows the condition of the "saf" and notifies through the LCD. Firstly, the LCD will display "Please Straighten the Saf" as shown in **Figure 7** when the *imam* who lead the prayer will turn the Bluetooth system through his phone.

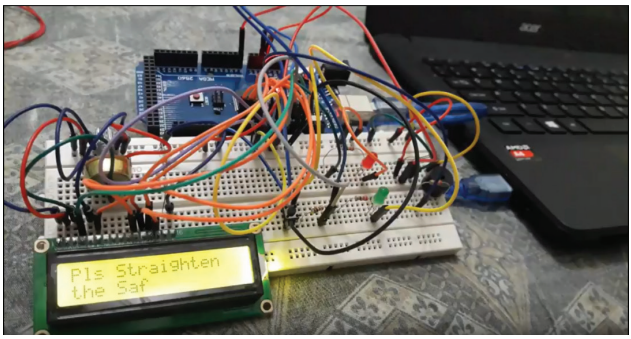

Figure 7: LCD shows "Pls Straighten the Saf"

Then, this part is utilized by "Saf Straightener Sensor Module" which the designed module consists of the Laser Module as the light-transmitting source and Light Dependent Resistor (LDR) as the tools in the line of sight (LOS) measurement. The Laser Module is a measurement device that is used to emit light at a particular wavelength and LDR is a light-controlled variable resistor in which the resistance of photoresistor decreases with increasing incident light intensity that exhibits photoconductivity. LDR can be applied in light-sensitive detector circuits and light and dark activated switching circuits. In this project, the light signal that received from the laser module is translated to the analog value via the LDR. Then the analog signal will be processed at the ATmega controller. If the LDR detects diffraction from the emitted laser, the red LED will turn ON, the LCD will display "Saf is not straight" as shown in **Figure 8**. If the "saf" is not straight, the buzzer will produce a sound to remind the *makmum* to straighten the saf immediately.

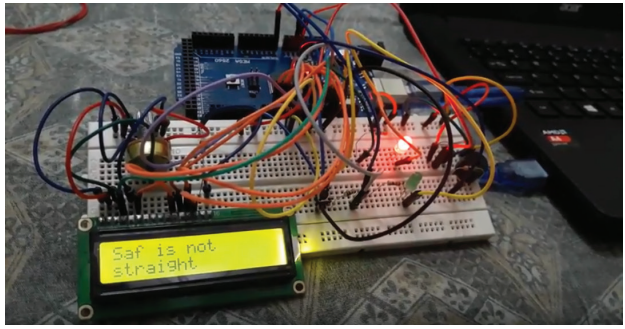

Figure 8: LCD shows "Saf is not straight"

Otherwise, green LED will light up and LCD will display "Saf is straight" as shown in **Figure 9.** Once the "saf" has been straightened, the *imam* will switch OFF the system by using his mobile phone.

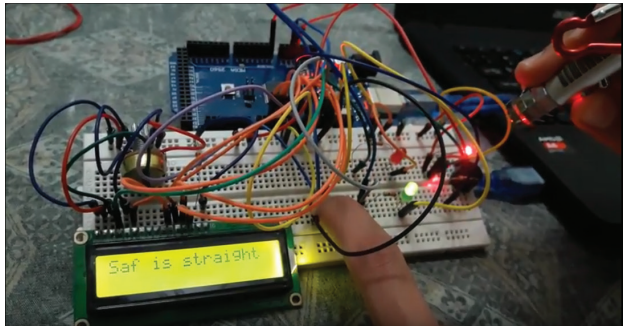

Figure 9: LCD shows "Saf is straight"

EXPERIMENT EVALUATION

Figure 10 shows the complete system diagram of the prototype which include Arduino Mega, buzzer, potentiometer, LED, LDR, LCD, Bluetooth Module, 1-kohm and 330-ohm resistor that had been used on the breadboard.

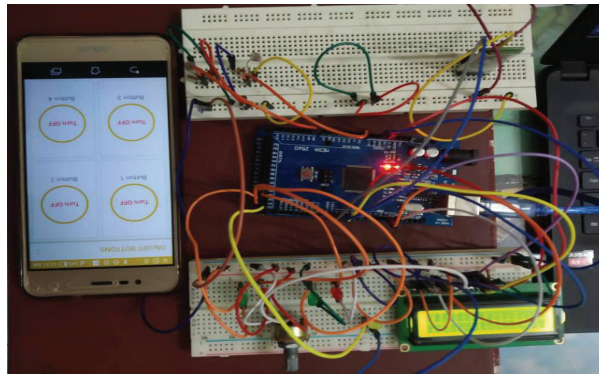

Figure 10: The complete setup of the project.

The prototype that had been built to implement and demonstrate the full system of "Saf Straightener Monitoring System" in real life is shown in **Figure 11.**

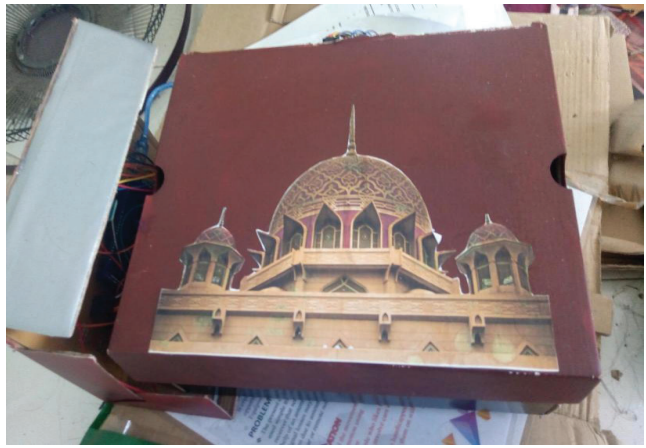

Figure 11: The Prototype

Table 2 shows the results attained (input and output) from the prototype after executing on PCB.

Table 2: Results attained on PCB

Input	Output
Bluetooth Module	• Yellow LED will light up. • LCD displays "Pls straighten the saf".
Laser (without diffraction)	• Both green LED light up. • LCD displays "Saf is straight".
Laser (with diffraction)	• One or both red LED light up. • LCD displays "Saf is not straight" • Buzzer emits 1kHz sound

DISCUSSION AND CONCLUSION

As for a conclusion, this project managed to achieve the target and can be used as a test at any mosque during the congregational prayers. This project also run as it should be operating. All component that were used also did not have any problem when the system is running. It also can be summarized that "Saf" Straightener Monitoring System can be programmed, design and build with the aid of Arduino software, Proteus software and other components such as Arduino Mega, Bluetooth module, LCD display, photo-resistor (LDR), buzzer and LED.

Furthermore, with the help of few projects that have been done by others really lead this project to accomplish at the end such as laser measurement, people counter, ultrasonic rangefinder and many more. Due to several errors that occur during the process of completing the project, precaution is the most important thing in order to reduce error especially when handling with hardware and the coding needed to be understand correctly. Hopefully this project can contribute and give some good impact to all person and can help people by making their works easier.

There are few recommendations need to be considered. This project only uses a low range of laser. In order to upgrade the prototype and to be used at mosque, high power and high specifications laser can be used into

further distance that are needed in order to reach the end of the "saf" at mosque.

Then, this project used only DC supply as the power source. Alternatively, AC supply could be used to replace the DC supply so that this project will operate and execute efficiently. Next, the LCD display could be replaced with other devices such as screen or television so that the word that displayed on the screen could be seen by the people that are far away behind.

ACKNOWLEDGEMENT

The authors would like to thank Research Management Institute of Universiti Teknologi MARA (UiTM) for providing financial support under G-Best fund grant title loT "Saf" Straightener Monitoring System during Congregational Prayers Using Arduino as a Microcontroller.

REFERENCES

Abu Bakar, Z, & Seli, H, (2015). "Kebaikan dan Kelebihan Solat Mengikut Perspektif Sains dan Bio-Perubatan," in *Proc. KAIB VIII*, pp. 683-687.

Abu Daud, Sulaiman bin al-Ash'ath al-Sijistani (202-275H), Sunan Abi Daud (Kitab Al-Salat) Book 2, Hadith 666. Maktabah al-Ma'arif, al-Riyadh

Al-Bukhari, Muhammad bin Ismail Abu Abdillah al-Ju'fi (194-256H), Sahih al-Bukhari (Call to Prayers (Adhaan) Book 10, Hadith 723. Darussalam, al-Riyadh.

Aziz, N.A.A, (2011). "Kaedah Menangani Stress dengan Solat." *Journal of Islamic and Arabic Education*, vol. 3, pp. 1-10.

Halvorsen, H.P, . Lecture, Topic: "Introduction to Arduino: An Open Sourcing Prototyping Platform", *Faculty of Technology, Natural Sciences and Maritime Sciences, University College of Southeast Norway*.

Hazirah, CW , Elektrik di dalam tubuh manusia. Retrieved Feb. 11, 2013, from http://tanpenshoosetsu.blogspot.my/2013/02/elektrik-di-dalam-tubuh-manusia.html.

Ibrahim, F, Abas, W. A. B, & Ng, S. C. (2009). Solat: Kebaikan dari Perspektif Sains, *Universiti Malaya*.

Ibrahim, F, & Ng, S.C., (2014). Solat sebagai Terapi Minda, *Universiti Malaya*.

Misri, M.A,. (2012). 400 Kesalahan Dalam Solat.*Al Hidayah House of Publishers Sdn. Bhd*, pp. 179-181.

Muslim bin al-Hajjaj, Abu al-Husain al-Qushairi al-Naisaburi (204-261H), Sahih Muslim (The Book of Prayers) Book 5, Hadith 432. Darussalam, al-Riyadh.

Raiz, R, Ismail, F, & Latif, M. W. A (2011) . Ensiklopedia Solat: Kombinasi Fakta Hukum dan Sains, *Telaga Biru Sdn. Bhd*.

Salleh, A.S.M, (2016). Petikan Khutbah Jumaat, Topic: "Betul dan rapatkan Saf dalam Solat", *Universiti Malaysia Terengganu (UMT),* Nov. 11, 2016.

Wan Ramli, W.M (2007). "Kajian Sains Fizik Tentang Solat Jemaah." *Berita Harian* (Jan. 13, 2007).

Waveshare.Laser Sensor User Manual. Retrieved Apr. 12, 2018. https://www.waveshare.com/w/upload/9/93/Laser-Sensor-UserManual.pdf.

Zainuddin, N.Z, Aurani, J., Rosmani, A.F., Wan Naimah Wan Daud, W. N. W., & Dali, H.D (2014). "Solat Bio Therapy Module*." Jurnal Intelek*, vol. 9, pp. 23-33.