



DEVELOPMENT OF THE QUEUE MANAGEMENT SYSTEM TO PRIORITIZE HANDICAPPED PERSONS

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ABSTRACT

Queue Management System is a system that manages the queuing number of the given customer in obtaining services. One of the problem arise normally is the long wait in the queue, due to system inefficiency regardless at the government or private sector. To make matter worse, some services in the current Queue Management System does not give any priority to elderly people, pregnant woman, and handicapped person. The purpose of this system is to propose a proof of concept of a Queue Management System that able to give priority to handicapped person automatically. This article presents the design of the Queue Management System that expected the result to prioritize handicapped person.

Keywords: queue management system; handicapped person; arduino.

INTRODUCTION

Time wasted during queuing to get a service such as in the bank is generally unavoidable. According to a research done by Telegraph, the average wasting time for an adult waiting in a bank is about 27 minutes per month and from the survey showed that 88% of people dissatisfied with the long queue[12].

Normally, customers go to the bank for any bank services would require the person to get the queue ticket. The queue number is then printed on a piece of paper for customer reference. The use of paper itself has cause non environment friendly practice. Afterwards, customer will spend time at the waiting area until their number being called out from the service counter. Some customer even just go to other places first and when they come back they have missed the queue and need to restart another queuing process. This can be a physiological barrier for customers worrying leaving the waiting area will result disconnect them from the queuing system and leading to increased waiting times upon coming back to the bank [5]. It is seriously affected the urbanite daily routine and kind of waste of time, money and resource resulted enormous economic losses to the developments of the society.

The general meaning of “handicap” interpreted as “a disadvantage that makes achievement unusually difficult”. In general, “handicapped” referring to a particular type of “disadvantage” in physical, mental, emotional disability or impairment which makes achievement unusually difficult and is an artificial grouping created by the labelling process in our society. In early stage, the different between “handicapped” and “normal” has been arbitrarily drawn by the “normal” majority even though various disabilities called

“handicaps” have nothing in common except the label itself [4].

Based on past literatures, several attempts have been done to address the long waiting time. Countertop Ticket Eater (DL 5000 Ticket Eater Manual) was published by Deltronic Labs from United States America in 1995 with function of this high speed and fully automated ticketing machine is to count and destroy the ticket then followed by issuing a receipt. This machine contains an external LED display and resettable electronic counter [2].

Ticket Vending Machine (TVM) was published by Tan from Malaysia in 2001 [9] with the function of produce tickets once the user has completed the selection of the type and ticket’s quantity through the touch screen display interface then follow by payment. The tickets will be printed and dispensed out to the customers and all the transactional data and audit history will be uploaded to System Manager on scheduled basis via local network link for accounting purposes.

Easy Turn Multi-Counter was published by Bhupendra Kara in 2004 [3]. This project is a Multi-Counter Queuing System that has been designed for all queue management needs.

Beside this, an Arduino based paperless Queue Management System which was published by Jidin, *et al.* in October 2016. The authors used the GUI, GSM and Arduino UNO to get the SMS queue number also provides SMS reminder functionality to remind the nearly upcoming customers [1].

V-Count Queue camera utilizes the accurate tracking 3D depth sensing technology to deliver optimal queue management in the people counting market. Queue



can accurately calculate the number of customers at the checkout queue also the average time spend at them [7].

QB10 Queue Management System (QueueBee) integrates seamlessly with conventional Queue System by giving real-time queue status on smartphone and allowing users to queue remotely [8].

WAVTEC - Mobile Queuing System which assigns ticket numbers using a smartphone, allow users to book online appointments, provides directions to the nearest branch, App shows alerts once number is up and SMS/ text message notifications will be send to users [14].

Skiplino (Queue Management System) with the ability to see the length of the customer's waiting times then allows the user to take a proactive, empathetic approach to respond quickly to demand from the visitors [10].

QMS 700i and its comprehensive range of system software and hardware capabilities to suit the customer's requirements. The system incorporated in network security, mobile technology, system scalability and reliability [11].

Q-net Pro appointment module SH42 consists of the function of web-based appointment. It provides the function like SMS and alerts the customer before the appointment [6].

Nevertheless, none of the literatures addresses the need of the needy persons like the handicapped person. Thus, this project objective aims to propose a proof of concept of Queue Management System (QMS) that has the feature that automatically detects and give priority for the handicapped person by is improved from the normal queue management system by included RFID system to scan and register the handicapped person or "OKU" card.

This research has used Arduino microcontroller to run the main program. Several project also has been using Arduino such as educational kits and gamification project as mentioned in [7-17].

METHODOLOGY

Figure-2 to Figure-4 show the expected project layout for Automatic Queue Number Reservation System. The keypad function is to let user key in the input selection for the transaction. TFT LCD is used as the output to display the queue number and counter number. Buzzer is used as an output where it will produce a "beep" sound to inform the customer the next queue number has been called out. The push button is used for the officer to press and call for the next queue number. RFID card is used by the handicapped person or "OKU" to scan and obtained the privilege to skip the queue for the bank service.

Figure-5 illustrates the architecture of the proposed QMS system in the form of block diagram. Arduino Mega 2560 acts as the processing unit for this system, ESPressor Lite V2.0 module used as communication peripheral and 2.4 TFT LCD screen to display the queue information to the customers. RFID module connects to the processor unit used to detect the handicapped privilege card, which allows the handicapped to cut the queue.

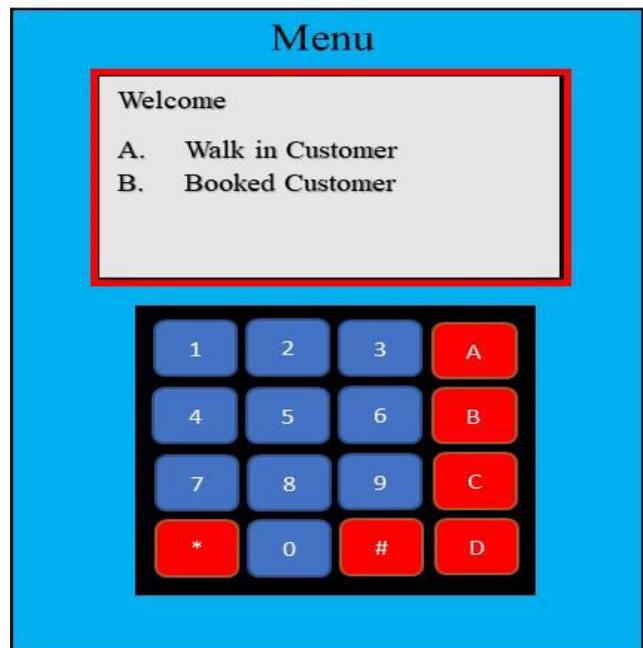


Figure-1. Project Layout for the counter system.

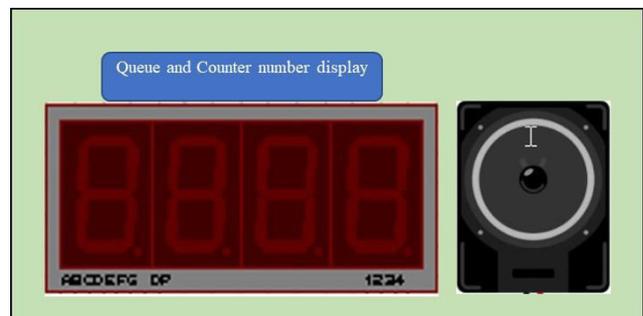


Figure-2. Project layout for queue and counter number display.



Figure-3. Project layout for hardware of officer.

Figure-6 shows the overview in a bank where the customer proceeds to the ticket counter to get a digital queue ticket by entering the mobile phone number and select the desired transaction. The system will proceed to send a queue number to the customer mobile phone and customers will be waiting at a designated area. The queue



number being called out and customers need to proceed to the counter for the services

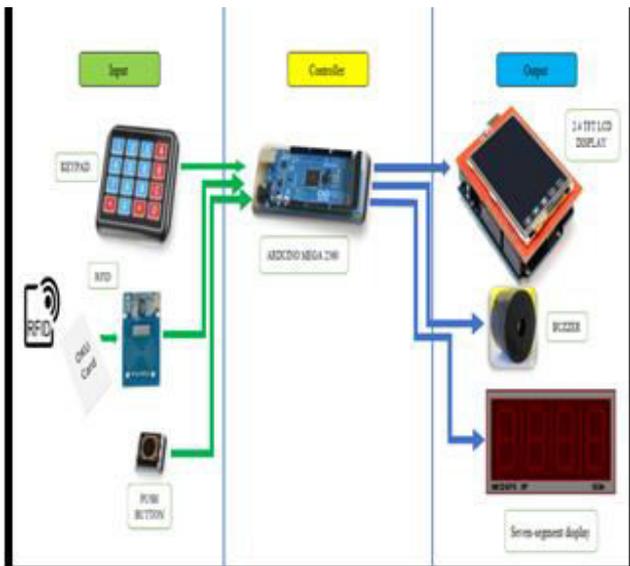


Figure-4. Block Diagram of the project.



Figure-5. Project overview in Bank.

Pseudocode 1 shows the flow of the program which the walk-in customer needs to select the desired transaction through keypad and enter the mobile phone number. Then, the customer will receive the queue number through mobile message. For the handicaps, they need to scan their card then follow by select the transaction and key in the mobile number. The system will skip the queue and prioritize to call for the handicaps queue number for the bank services.

Pseudocode 1: Pseudocode of the Program

```

if customer is present then
if customer is OKU then
if passcode is correct then
display que number for customer
arrange the que number for customer
else
request customer to repeat the process
end
else
    
```

```

display que number for customer
end
end
if customer service press the button then
if OKU customer is present then
display que number of OKU customer
else
display que for normal customer
end
end
end
    
```

Figure-6 shows the Bill of Material (BOM) of the Queue Management System that prioritizes the handicapped person “OKU” project. Based on the BOM list, the QMS consists of main module of Arduino Mega 2560 microcontroller and three sub-modules which is ticketing counter system, queue number display system and bank officer queue number calling system.

For the ticketing counter system, the important constituent parts are 4x4 keypad, RFID-RC522 reader and 2.4-inch Thin Film Transistor Liquid Crystal Display 9341 (TFT LCD). The function of the 4x4 keypad is to let the bank customers select the desired services and the queue number will be displayed on the 2.4-inch TFT LCD. The function of the RFID-RC522 reader is to scan and read the handicapped person or “OKU” card and registered the card for giving them the priority on the bank services.

The queue number display system is built with the component using 16x2 LCD. When the bank officer calls for the next customer, the queue number will be displayed on the 16x2 LCD. While the device built for the bank officer for queue number calling system consists of push button and buzzer. The function of push button is to call out for the next customer for the services and the buzzer is to inform the customers that the next queue number is being called out.

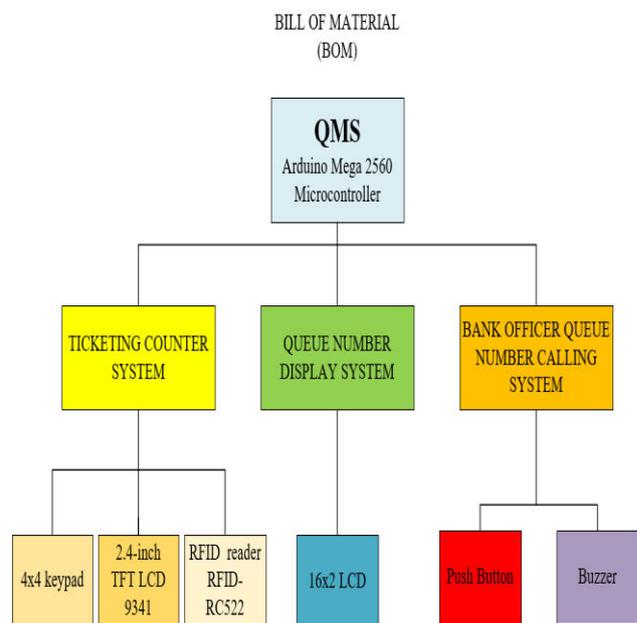


Figure-6. Bill of Material (BOM) of the project.



Figure-7 shows the whole system schematic diagram of the project. The schematic diagram consists of Arduino Mega 2560 microcontroller, RFID reader, 2.4-inch Thin Film Transistor Liquid Crystal Display (TFT LCD), 4x4 keypad, buzzer and push button are used to display the queuing information system. From the schematic diagram, the Arduino Mega 2560 is connected to 2.4-inch Thin Film Transistor Liquid Crystal Display (TFT LCD) with Arduino pin number (1, 5, 6, 7, 15, 16, 17, 18, 23, 24, 25, 26, 30, 92, 93, 94, 95, 96, 99 and 100) connected with 2.4-inch TFT LCD module pin name (D4, D5, D2, D3, D6, D7, D0, D1, D10, SDI/SDA/D11, D12,D13, RESET, RD, WR, RS, CS, RST, LEDK and LEDA).

The Arduino pin number that used to connect with 16x2 LCD are pin number (10, 11, 43 & 44) which the 16x2 LCD pin number that connected with Arduino Mega are (VDD, VSS, SCL & SDA). The RFID reader pin number that used to connect to Arduino Mega 2560 are (2, 3, 4, 8, 6, 7 & 1) which the Arduino Mega 2560 pin number that connected to RFID reader are (20, 21, 22, 31, 32, 35 & 36). The RFID reader pin 8 was connected to VCC and pin 6 was connected to GND. For the 4x4 keypad, the keypad column 1 to 4 and keypad row 1 to 4 are connected to Arduino Mega 2560 pin number (71, 72, 73, 74, 75, 76, 77& 78). As for the push button 1 and push button 2 were connected to Arduino Mega 2560 pin 46 and 45. While buzzer was connected to Arduino Mega pin 59. Please refer to the below schematic diagram for more details.

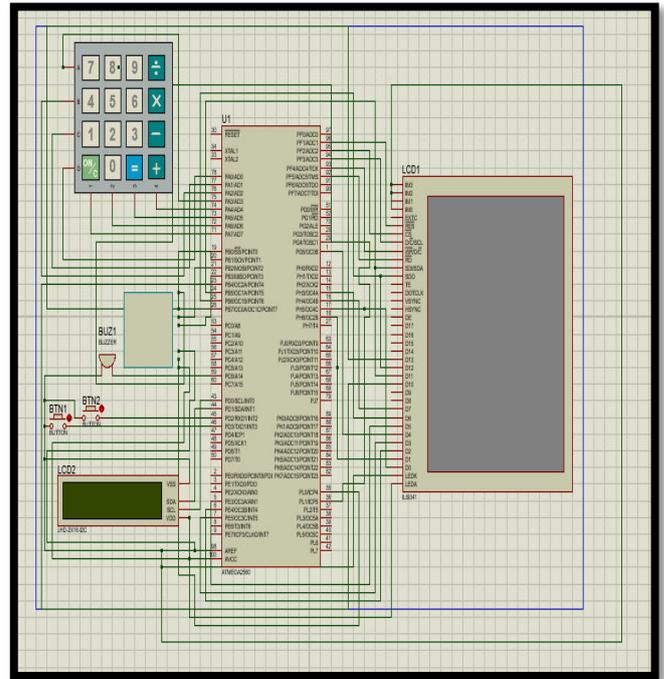


Figure-7. Schematic Diagram for the whole system.

RESULTS

The expected result of the operation for this kit is discussed in the Table 1 below.

**Table-1.** Explanation of the functionality of the result.

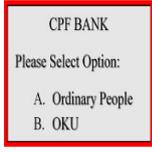
NO	EXPLANATION	EXPECTED RESULT	REAL RESULT
1.	When power supply is connected, the TFT LCD will display the main menu that shows: Please Select Option: A. Ordinary people B. OKU	 TFT LCD display the main menu	 TFT LCD display the main menu
2.	Customer to select the option by using the keypad as input to the system. "A" for Ordinary People or "B" for OKU	 Select the option for the desired services	 Select the option for the desired services
3.	If customer select option "A", the system will prompt out option for customer to select the desired transaction either to: C. Create New Account D. Apply Loan	 Select the desired transaction	 Select the desired transaction
4.	After customer select the desired transaction, the system will display the digital ticket queue number to customer.	 Display queue number	 Display queue number
5.	16 X 2 LCD display shows the queue number and counter number: Counter A: 1001	 16x2 LCD display the queue and counter number	 16x2 LCD display the queue and counter number
6.	If the customer selects the "OKU", system will prompt to scan the "OKU" card	 TFTLCD display the "Scan your card"	 TFTLCD display the "Scan your card"
7.	If the walk-in customer is handicap person or "OKU" will need to scan the OKU RFID card to get the queue number.	 Handicap person or "OKU" scan the card for queue number	 Handicap person or "OKU" scan the card for queue number
8.	Officer will skip the queue and call the "OKU" number for bank services	 16x2 LCD display the queue and counter number for "OKU" customer	 16x2 LCD display the queue and counter number for "OKU" customer



Figure-8 shows the sequences simulation for the bank customers and officer. From Figure-9, the sequences are started from the ordinary “customer 1” select the desired transaction to create “New Account”. Followed by the next customer also choose for the same services that is to create “New Account”. The bank officer from “Counter A” will pressed the push button to call for the first customer. Meanwhile, third customer is coming to the bank and choose the transaction for “Apply Loan”. “Counter B” officer will pressed the push button to call for the next customer for the service of “create new account”. The fourth customer choose to select the transaction of “Apply Loan” and after that the handicapped person or “OKU” customer come to choose the service of “Apply Loan”. In this scenario, when “Counter A” officer press the calling button, the system will automatically call for the handicapped or “OKU” customer for the service of “Apply Loan”. The fifth customer came for the service of creating “New Account” and when the “Counter B” officer proceed to service next customer, the system will call for the third customer which request service for “Apply Loan”. When the second handicapped or “OKU” customer arrive at the bank and the customer choose to create “New Account” services, hence when the “Counter A” officer pressed the button the system will immediately service the handicapped or “OKU” customer. Then, the “Counter B” officer will be serving for the fourth customer who request “Apply Loan” services and finally “Counter A” officer will call for the fifth customer who also request to create “New Account” services.

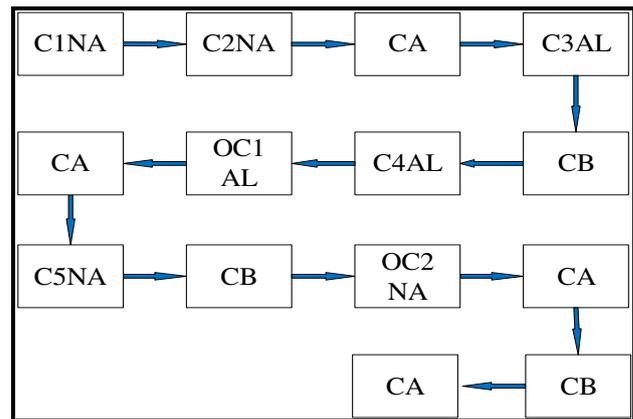


Figure-8. Sequences simulation for the bank customers and officer.

C1NA	Customer 1 create New Account
C3AL	Customer 3 Apply Loan
CA	Counter A
CB	Counter B
OC1AL	OKU Customer 1 Apply Loan
OC2NA	OKU Customer 2 create New Account

Figure-9. Explanation for the services.



Table-2. Sequences Explanation and real results for the ordinary customer with new account services and “Counter A” function.

Sequences	Expected Results	Real Results
	Your number is: 1001 Number of queue is: 1	
	Your number is: 1002 Number of queue is: 2	
	Your number is: 1003 Number of queue is: 3	
	Counter A: 1001	
	Counter A: 1002	
	Your number is: 1004 Number of queue is: 2	
	Your number is: 1005 Number of queue is: 3	
	Counter A: 1003	
	Your number is: 1006 Number of queue is: 3	
	Counter A: 1004	
	Your number is: 1007 Number of queue is: 3	
	Counter A: 1005	
	Counter A: 1006	
	Counter A: 1007	

Table-3 shows the survey questions filled by 50 respondents.



Table-3. Survey Questionnaires.

Q1. Do you agree that the handicapped/disabled people or “OKU” should be prioritized and have privileges than normal people?

1. Extremely Agree
2. Slightly Agree
3. Agree
4. Slightly Disagree
5. Strongly Disagree

Q2. Do you have or know any handicapped person in your family members or friends?

1. Yes
2. No

Q3. Do you agree that there is no privilege given to handicapped person or “OKU” either in government and private sector?

1. Extremely Agree
2. Slightly Agree
3. Agree
4. Slightly Disagree
5. Strongly Disagree

Q4. Have you seen any features that giving prioritize to handicapped person or “OKU” at bank?

1. Yes
2. No

If yes, please indicate: _____

Q5. Do you agree that this Queue Management System that prioritize for Handicapped person or “OKU” will benefit for handicapped person?

1. Extremely Agree
2. Slightly Agree
3. Agree
4. Slightly Disagree
5. Strongly Disagree

If your answer is slightly or strongly disagree, please indicate your answer here:

Q6. Do you agree that with this newly added feature will help to improve the satisfaction on the bank service for the handicapped person or “OKU”?

1. Extremely Agree
2. Slightly Agree
3. Agree
4. Slightly Disagree
5. Strongly Disagree

Q7. Do you think that this Queue Management System that prioritize for Handicapped person or “OKU” is user-friendly and eco-friendly (paperless)?

1. Yes
2. No

Q8. Do you think that this Queue Management System that prioritize for Handicapped person or “OKU” can be implemented at more places?

1. Yes
2. No

If Yes, please tick on the places that you think is appropriate.

- Bank
- Post Office
- Hospital
- Immigration Office
- Polyclinics
- SAJ
- Tenaga National
- Telecom

Others, please indicate: _____

Q9. Do you think that the price (around RM280) for this system is worth to be adopted?

1. Yes
2. No

If no, why? _____

Q10. Any suggestions to improve the project?

1. Yes
- No

If Yes, please elaborate here:



Figure-10 shows the results of feedback survey questionnaire that conducted on 50 people bank's customer who had volunteered for the survey. The total number of respondents consists of 17 males and 33 females. The age of the volunteers are between 18 to 74 years old and the average age of the volunteers is about 42 years old. There are total of 10 questionnaires were prepared in the survey form.

Prior conducting the feedback survey questionnaire, the volunteers were shown the product, demonstrate and explain the functionality of the prototype. In order to let the volunteers to have a clear picture and understanding in the prototype, Q&A sessions also were conducted during the questionnaire survey.

Based on the survey results, there are four questions scored the same highest point (50) and the questions were for the number 4, 7, 8 & 9. For question number 4, all the respondents claimed that they have never seen any features that giving priority to handicapped person or "OKU" in the bank. Followed by question number 7, all the volunteers are having consensus in they think that this Queue Management System that prioritize for handicapped person or "OKU" is user-friendly and environment friendly due to paperless. For question number 8, all the respondents were agreed to implement the system at other service sectors such as Post Office, Hospital, Immigration Office, Polyclinics, SAJ, Tenaga National, Telecom etc. On final questionnaire, all the respondents were agreed that the price for this system is worth to be adopted in any service sectors.

The second highest point in this feedback survey is question number 2 which scored 46 points out of 50 points. 92 percent of the respondents do not have or know any handicapped person in their family members or friends while only 8 percent of the volunteers are having or known any handicapped person in their family members or friends. Based on the survey results, it shows that the modern society are very concern with handicapped people and recognized toward those needed help.

The third highest score is question number 6. There are 41 persons "Extremely Agree" that this newly added feature will help to improve the satisfaction on the bank service for the handicapped person or "OKU". While there are 4 persons "Slightly Agree" and 5 persons "Agree" for this new feature will help to improve the satisfaction on the bank service for the handicapped person or "OKU".

There are 38 persons vote for "Extremely Agree" that this Queue Management System that prioritize for handicapped person or "OKU" will benefit for handicapped person. 37 persons "Extremely Agree" that the handicapped people or "OKU" should have the priority and privilege than normal people. 32 out of 50 respondents assume and vote for "Extremely Agree" that there is no privilege given to handicapped person or "OKU" in either government or private sector service. There were several feedbacks received from the respondents to improve the project such as implement "more services" with "Bluetooth" and "IoT", as well as to include design for those "injured person" instead of "OKU" only, integrate

with mobile application and improve the service choices based on the demand and request in the market.

CONCLUSIONS

This project is attempting to design an Automatic Queue number reservation system that give privilege to the handicap person or "OKU" to skip the long queue. A survey is done in order to verify the effectiveness of the proposed system. As a conclusion, this project has met the satisfaction among the respondent.

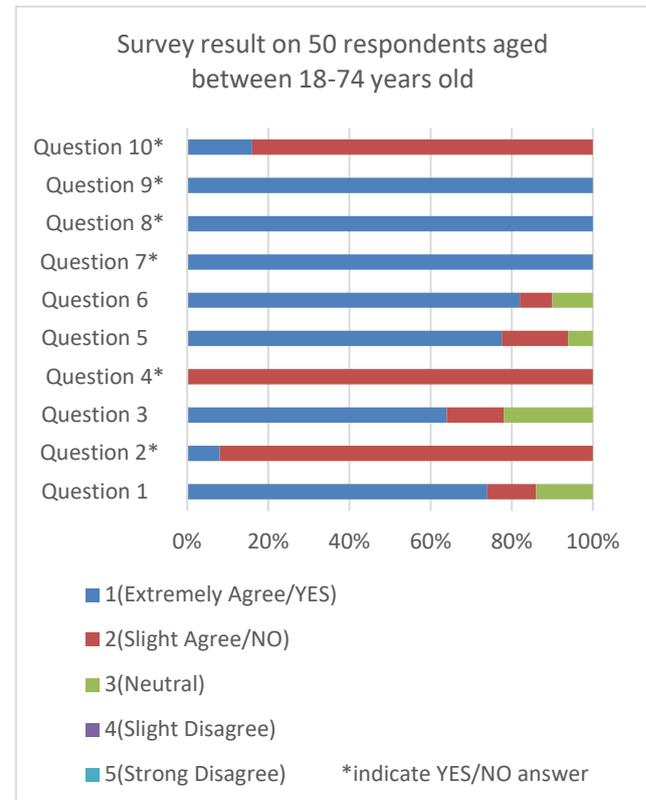


Figure-10. Survey Results for total of 50-person volunteers.

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