MYBCOT - Digital Contact Tracing for Carmexss Jeepney through Raspberry Pi

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Abstract: - During the closing months of 2019, a virus spread known as the Covid – 19. Different countries induced drastic actions to stop the virus, and one of the intervention methods is Contact Tracing. Covid-19 who wreaked havoc globally and made it difficult for governments to implement a reliable contact tracing system, and one of those countries is the Philippines. MYBCOT (MySQL BarCode Operating Temperature) Digital Contact Tracing is a study that aims to create digital contact tracing for Public Utility Jeepney (PUJ). The study is intended for Carmexss PUJ cooperative, a newly implemented transportation service in the province of Pampanga. The study consists of two major parts, the website, and the MYBCOT (MySQL BarCode Operating Temperature) device. The website aims to give access to all passengers for registration through the website and the generation of their ID with the passenger's barcode in it, which will be scanned on the MYBCOT device. The MYBCOT device integrates Raspberry Pi 2B, MLX90614 thermal sensor, and a barcode scanner. Through these, the study aims to create a better tool for contact tracing method as an intervention for PUJs against Covid – 19 and future phenomena where contact tracing is needed.

Key Words: — ***Barcode Scanner, Contact Tracing, Covid-19, Database, Raspberry Pi, Temperature Sensor.***

I. INTRODUCTION

The Severe Acute Respiratory Syndrome Coronavirus 2 (SARS- CoV-2) virus and its accompanying sickness, coronavirus disease 2019 (COVID-19), was first diagnosed in China in late 2019, the most dangerous public health hazard in the previous century. This sickness has spread like wildfire over the world. The global response to the epidemic has been uneven. Some governments respond proactively and effectively, while others failed miserably. One strategy for restricting viral spread is implementing strict lockdowns, yet the action has an Economic cost, which may lead to businesses closing and employees losing employment. There is a possibility that the spread will resume once the lockdowns are triggered [1].

Manuscript revised August 02, 2023; accepted August 03, 2023. Date of publication August 06, 2023.

This paper available online at www.ijprse.com

ISSN (Online): 2582-7898; SJIF: 5.59

The COVID-19 pandemic's spread has a significant effect on people's daily transit behaviors and mobility patterns (Transportation Engineering 2021). For the prompt application of corrective actions at the appropriate location, it is necessary to comprehend the disease transmission patterns and their pathways among nearby people. Some countries around the globe are utilizing improvements in smartphones and the Internet of Things (IoT) to assist the existing manual contact tracing and follow people who have had direct contact with recognized COVID-19 cases [1].

As we emerge from the pandemic coronavirus disease 2019 (COVID-19), we may reflect on the procedures to protect those delivering and receiving treatment. The World Health Organization's current worldwide patient safety concern is medication safety (WHO). It is a complicated web of sociotechnical connections. Implementing technology such as barcode scanning in purchasing, administering, managing, and settlement is feasible to provide a safer procedure [2].

A barcode consists of a sequence of stripes that hold information in a manner that we read by technological equipment. Barcodes are used because of the high number of supplies. A two- dimensional structure is required to express

higher quantities of information, and a two-axis scan - horizontally and vertically - is necessary for reading. A computer database is required when working with linear barcodes [3].

In developing countries, quantifying close relationships can help design intervention efforts like vaccination. We present and examine data from prospective research that tracked five rural Kenyan homes over three days. Residents of a particular household wore wearable proximity sensors to record information about their close face-to-face encounters [4].

Most COVID-19 contact-tracing applications employ Bluetooth signal strength to calculate the distance between cellphones and determine exposure status depending on the distance and length of closeness to an infected individual. Bluetooth-based apps based on a framework built by Singapore's Government Technology Agency have been launched in Alberta, Australia, and Singapore. In France and Switzerland, separate procedures are being developed. Location information is used to calculate proximity to infected persons. Barcoding tactics are an alternate method of tracking digital contacts. Quick Response (QR) codes (scannable barcodes) can be put in public settings such as bus doors and store entrances, allowing users to register visited locations [5].

Many studies are being conducted to monitor, trace contacts, anticipate, and diagnose the COVID-19 illness, and many virologists are working hard to develop a vaccine as soon as feasible. Even though there is no particular treatment for the pandemic sickness, the globe is attempting to restrict its spread by instituting a global lockdown and educating people to use masks and sanitizers. The Internet of Things (IoT) and other new technologies are drawing international attention to the rising technology assistance in healthcare systems, notably in predicting, preventing, and monitoring most infectious illnesses. Similarly, it aids in the battle against COVID-19 by monitoring, contract tracking, and identifying the COVID-19 pandemic using IoT-based intelligent solutions. The Internet of Things (IoT) is a linked Web of smart devices, sensors, actuators, and data captured in raw form and communicated through the internet. This research aims to offer a method for detecting and monitoring asymptotic patients using IoT-based sensors [6].

Studies also show that the existence and implementation of mass-based automated passenger counters in a public mode of transportation is vital for dealing with illnesses such as the COVID - 19. The drawbacks of such performance are the expensiveness and the inaccuracy in these nowadays most existing automated passenger counters through the use of infrared beam methods [7].

MYBCOT is a device that can use for contact tracing and better medical monitoring of high-risk individuals. They allow users to self-report their daily temperature and any signs of infection they may have observed. The components the researchers used to make the device are Raspberry Pi Model 3b, thermal sensor, barcode scanner, liquid crystal display (LCD), Jumper Wires, HDMI connectors, numeric keypad, and prototype casing.

II. METHODOLOGY

The conceptual framework of the study input, as shown in Figure.1.

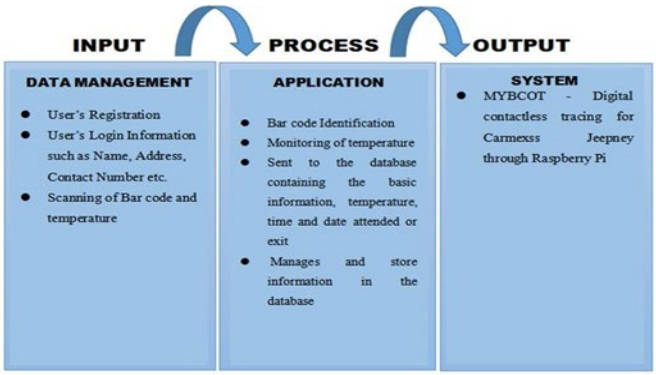

Fig.1. The Conceptual Framework of the Study MYBCOT - Digital Contact Tracing for Carmexss Jeepney through Raspberry Pi

2.1 Research Design

The design that applies to the research study is a quantitative design. Under this design, the researchers will use experimental research to compare a new digital contact tracing to the traditional method which uses man power on conducting contact tracing with the use of pen and paper.

2.2 Schematic Diagram

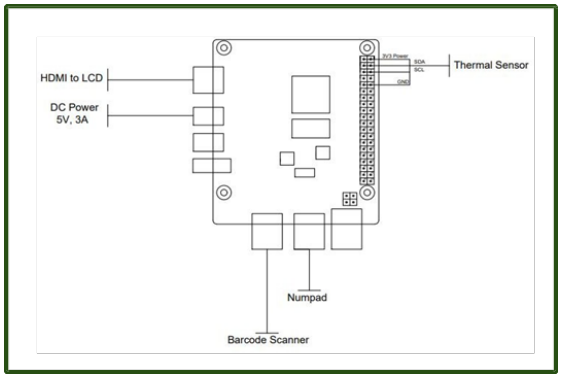

Fig.2. Connection diagram of the MYBCOT - Digital Contact Tracing for Carmexss Jeepney through Raspberry Pi

2.3 Research Instruments

The researchers used an interview as an instrument in gathering data. An interview is a one-on-one interaction in which the researchers ask oral questions in order to obtain an oral answer from the respondent. The questions used in the interview were formed by the researchers through brainstorming and were used in order to obtain data about what a quarantine facility looks like in reality. The data gathered were used in replicating the facility which is needed to test the prototype.

III. Results And Discussion

Temperature measurements Recorded from March 03 - Apr 2, 2023 in route from Arayat to San Fernando, Pampanga.

Table.1. Average recorder temperature using thermometer

TEMPERATURE FROM THERMOMETER									
	March 11		March 11		March 11		March 11		April 2
Respondent 1	36.3	Respondent 11	34.6	Respondent 21	34.4	Respondent 31	36.8	Respondent 41	36.3
Respondent 2	36.3	Respondent 12	36.1	Respondent 22	35	Respondent 32	35	Respondent 42	36.1
Respondent 3	36.1	Respondent 13	36.3	Respondent 23	36.2	Respondent 33	36.3	Respondent 43	36.3
Respondent 4	35.7	Respondent 14	35.4	Respondent 24	36.1	Respondent 34	36.1	Respondent 44	36.1
Respondent 5	34.9	Respondent 15	35.8	Respondent 25	36.4	Respondent 35	36.4	Respondent 45	36.2
Respondent 6	36.2	Respondent 16	36.3	Respondent 26	36.8	Respondent 36	35.4	Respondent 46	36.4
Respondent 7	35	Respondent 17	36.1	Respondent 27	35	Respondent 37	36.2	Respondent 47	36.5
Respondent 8	34.9	Respondent 18	36.2	Respondent 28	36.2	Respondent 38	36.4	Respondent 48	34.6
Respondent 9	34.5	Respondent 19	36.4	Respondent 29	36.1	Respondent 39	36.3	Respondent 49	35.4
Respondent 10	34.9	Respondent 20	36.4	Respondent 30	36.4	Respondent 40	36.1	Respondent 50	36.2
AVERAGE TEMPERATURE: 35.88 °C									

The given data indicates the tested values of the respondent's temperature using a thermometer. The average temperature measured using a thermometer is 35.88 °C. The maximum recorded temperature is 36.8 °C, while the lowest is 34.4 °C. The table shows that the average recorded temperatures for each respondent are below normal, indicating that the data are inconsistent.

Table.2. Average recorder temperature using MLX90614

TEMPERATURE FROM THERMAL SENSOR OF THE DEVICE (MLX90614)									
	March 11		March 11		March 11		March 11		April 2
Respondent 1	36.8	Respondent 11	36.4	Respondent 21	37.2	Respondent 31	37.1	Respondent 41	37
Respondent 2	36.5	Respondent 12	36.3	Respondent 22	36.2	Respondent 32	37.2	Respondent 42	36.2
Respondent 3	36	Respondent 13	36.2	Respondent 23	36.1	Respondent 33	36.3	Respondent 43	36
Respondent 4	36.3	Respondent 14	36.3	Respondent 24	36.5	Respondent 34	36.3	Respondent 44	36.3
Respondent 5	36.6	Respondent 15	36.7	Respondent 25	36.9	Respondent 35	36.3	Respondent 45	36.5
Respondent 6	36.4	Respondent 16	36.5	Respondent 26	36.2	Respondent 36	36.3	Respondent 46	36.4
Respondent 7	36.4	Respondent 17	36.4	Respondent 27	36.7	Respondent 37	36.8	Respondent 47	37.1
Respondent 8	37.2	Respondent 18	36.3	Respondent 28	37	Respondent 38	36.3	Respondent 48	36.5
Respondent 9	36.8	Respondent 19	36.9	Respondent 29	36.8	Respondent 39	36.3	Respondent 49	36.4
Respondent 10	36.2	Respondent 20	37.1	Respondent 30	37.1	Respondent 40	36.5	Respondent 50	36.2
AVERAGE TEMPERATURE: 36.54 °C									

The data gathered above shows the tested values of the respondent's temperature from the thermal sensor of the device (MLX90614). The average temperature value of the thermal sensor of the device (MLX90614) is 36.54 °C. The table shows that the recorded temperatures show the normal temperature for each respondent; as stated by John Hopkins Medicine (2021), the normal body temperature is 36.4°C to 37.2°C, while fever is defined as a temperature of 38°C or higher.

Table.3. Average time spent using the manual pen and paper contact tracing method

FILLING DURATION USING PEN AND PAPER (IN SECOND)									
	March 11		March 11		March 11		March 11		April 2
Respondent 1	40	Respondent 11	49	Respondent 21	51	Respondent 31	48	Respondent 41	58
Respondent 2	48	Respondent 12	46	Respondent 22	53	Respondent 32	49	Respondent 42	59
Respondent 3	46	Respondent 13	50	Respondent 23	54	Respondent 33	43	Respondent 43	60
Respondent 4	40	Respondent 14	56	Respondent 24	57	Respondent 34	46	Respondent 44	60
Respondent 5	45	Respondent 15	59	Respondent 25	59	Respondent 35	48	Respondent 45	54
Respondent 6	56	Respondent 16	60	Respondent 26	59	Respondent 36	49	Respondent 46	40
Respondent 7	60	Respondent 17	58	Respondent 27	54	Respondent 37	46	Respondent 47	41
Respondent 8	42	Respondent 18	58	Respondent 28	54	Respondent 38	48	Respondent 48	48
Respondent 9	41	Respondent 19	56	Respondent 29	56	Respondent 39	52	Respondent 49	46
Respondent 10	48	Respondent 20	54	Respondent 30	58	Respondent 40	56	Respondent 50	45
AVERAGE DURATION: 51.26 sec									

The time spent using the manual pen and paper contact tracing method is shown in the data above. The average time for filling up is 51.26 seconds, according to data. The maximum filling time is 60 seconds, while the minimum is 40 seconds. According to Dr. Rolly Cruz (27 August 2021), Head of Quezon City's Epidemiology and Surveillance Unit, the primary tool of the contact tracing system during the onset of the pandemic was a pen and paper. A person's location and health status were recorded using a pen and paper. Health officials were able to call suspected instances using mobile phones. These ancient procedures were labor-intensive and time-consuming. As a result, manual contact tracing takes longer than digital contact tracing.

Table.4. Average amount of time spent logging with the MYBCOT device

LOGGING DURATION USING MYBCOT DEVICE									
	March 11		March 11		March 11		March 11		April 2
Respondent 1	10	Respondent 11	12	Respondent 21	13	Respondent 31	10	Respondent 41	11
Respondent 2	11	Respondent 12	10	Respondent 22	15	Respondent 32	10	Respondent 42	11
Respondent 3	10	Respondent 13	10	Respondent 23	12	Respondent 33	10	Respondent 43	12
Respondent 4	12	Respondent 14	10	Respondent 24	14	Respondent 34	10	Respondent 44	10
Respondent 5	10	Respondent 15	12	Respondent 25	12	Respondent 35	10	Respondent 45	10
Respondent 6	10	Respondent 16	11	Respondent 26	13	Respondent 36	11	Respondent 46	10
Respondent 7	12	Respondent 17	12	Respondent 27	11	Respondent 37	12	Respondent 47	12
Respondent 8	10	Respondent 18	14	Respondent 28	14	Respondent 38	13	Respondent 48	11
Respondent 9	10	Respondent 19	12	Respondent 29	13	Respondent 39	12	Respondent 49	14
Respondent 10	11	Respondent 20	11	Respondent 30	12	Respondent 40	11	Respondent 50	12
AVERAGE DURATION: 11.42 sec									

The data shown above represents the amount of time spent logging with the MYBCOT device. The average logging/scanning time is 11.42 seconds. The maximum and minimum logging times are 15 and 10 seconds, respectively. As a result, when compared to the manual procedure, this may speed up the contact tracing process. According to Dr. Rolly Cruz, Head of Quezon City's Epidemiology and Surveillance Unit, “Technology is vital in contact tracking and early intervention. Cases are immediately reported to us using these digital tools. As a result, we were able to visit patients immediately, provide appropriate support, and assist them in remaining safe”.

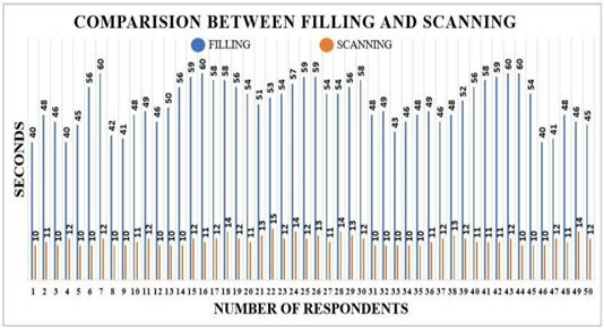

Fig.3. Comparison between filling and scanning

The data above compares filling up using the pen and paper manual contact tracing approach to scanning with the MYBCOT device. The data from the table were compared using the T-Test platform. As a result, there is a significant difference between manual and digital approaches. Manual tracing takes time to discover contacts. However, digital tracing allows a contact to receive a notification when an infected individual is recognized and their close contact with the passengers is identified.

Table.5. Average time spent searching for specific information using manual method

SEARCHING DURATION IN PEN AND PAPER METHOD (IN SECOND)									
	March 11		March 11		March 11		March 11		April 2
Respondent 1	150	Respondent 11	153	Respondent 21	143	Respondent 31	175	Respondent 41	125
Respondent 2	152	Respondent 12	145	Respondent 22	142	Respondent 32	165	Respondent 42	135
Respondent 3	179	Respondent 13	153	Respondent 23	145	Respondent 33	143	Respondent 43	165
Respondent 4	156	Respondent 14	142	Respondent 24	158	Respondent 34	156	Respondent 44	145
Respondent 5	145	Respondent 15	135	Respondent 25	168	Respondent 35	142	Respondent 45	165
Respondent 6	136	Respondent 16	168	Respondent 26	154	Respondent 36	153	Respondent 46	125
Respondent 7	135	Respondent 17	179	Respondent 27	158	Respondent 37	147	Respondent 47	135
Respondent 8	156	Respondent 18	165	Respondent 28	168	Respondent 38	159	Respondent 48	145
Respondent 9	156	Respondent 19	180	Respondent 29	143	Respondent 39	135	Respondent 49	156
Respondent 10	180	Respondent 20	140	Respondent 30	168	Respondent 40	126	Respondent 50	153
AVERAGE DURATION: 152.04 sec									

The data shown above represents the time spent searching for specific information using the manual pen and paper contact tracing approach. The average time for filling up is 152.04 seconds, according to data. With this time frame, manual pen and paper are time-consuming as of Rio Bautista (September 17, 2020), the handwritten data is not always readable, there is no way to validate if the data written is accurate, and the use of pen and paper adds unnecessary contact.

Table.6. Average time spent searching for specific information using MYBCOT device

SEARCHING DURATION IN MYBCOT DEVICE (IN SECOND)									
	March 11		March 11		March 11		March 11		April 2
Respondent 1	40	Respondent 11	49	Respondent 21	51	Respondent 31	48	Respondent 41	58
Respondent 2	48	Respondent 12	46	Respondent 22	53	Respondent 32	49	Respondent 42	59
Respondent 3	46	Respondent 13	50	Respondent 23	54	Respondent 33	43	Respondent 43	60
Respondent 4	40	Respondent 14	56	Respondent 24	57	Respondent 34	46	Respondent 44	60
Respondent 5	45	Respondent 15	59	Respondent 25	59	Respondent 35	48	Respondent 45	54
Respondent 6	56	Respondent 16	60	Respondent 26	59	Respondent 36	49	Respondent 46	40
Respondent 7	60	Respondent 17	58	Respondent 27	54	Respondent 37	46	Respondent 47	41
Respondent 8	42	Respondent 18	58	Respondent 28	54	Respondent 38	48	Respondent 48	48
Respondent 9	41	Respondent 19	56	Respondent 29	56	Respondent 39	52	Respondent 49	46
Respondent 10	48	Respondent 20	54	Respondent 30	58	Respondent 40	56	Respondent 50	45
AVERAGE DURATION: 51.26 sec									

The data shown above indicates the amount of time spent on the MYBCOT device searching for specific information. The average time for searching for information is 51.26 seconds. Based on the data, we may search the person's data in less than a minute and avoid unnecessary contact while obtaining data on the website.

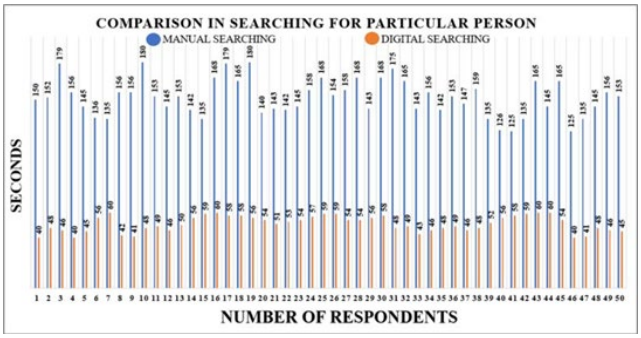

Fig.4. Comparison in searching for particular person

The data above represents the time spent searching for a particular person using the manual and digital contact tracing approach. Based on the data from the T-test, there is a massive difference between manual and digital searching. The average search for a particular person in manual contact tracing is

152.04 seconds compared to digital contact tracing, and the average time is 11.46 seconds.

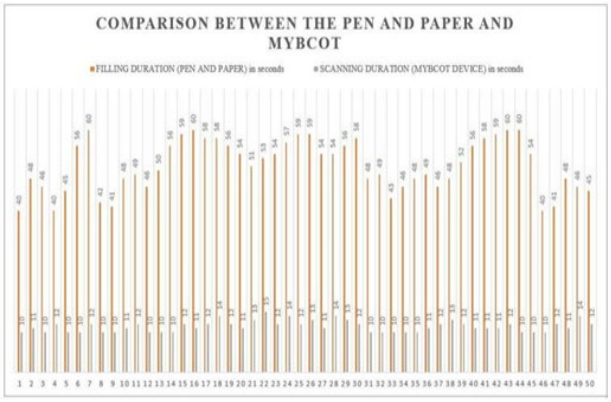

Fig.5. Comparison in filling up using the pen and paper manual contact tracing and MYBCOT approach

The data above compares filling up using the pen and paper manual contact tracing approach to the contact tracing method via logging with the MYBCOT device. There is a significant difference between manual and digital approaches. Manual tracing takes time to discover contacts. However, digital tracing allows a contact to receive a notification when an infected individual is recognized, and their close contact with the passengers is identified.

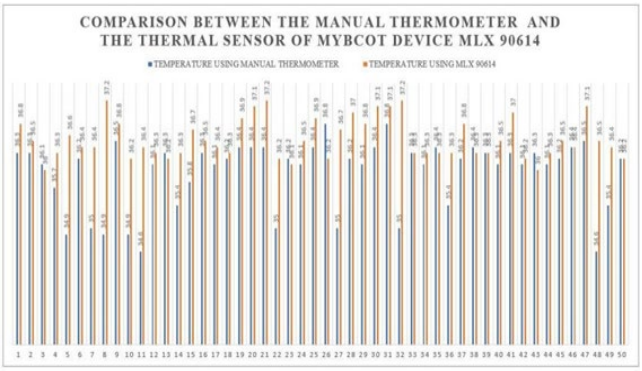

Fig.6. Comparison of the manual thermometer and the MYBCOT device's thermal sensor

The comparison of the manual thermometer and the MYBCOT device's thermal sensor resulted in the following results. The temperature measured with the thermometer is lower than the typical average temperature, which may cause data inconsistency. Variations in user technique, such as holding the scanner too far away from the forehead, can also affect accuracy. While the temperature was measured with MLX 90614, the average temperature of each respondent was normal. Temperature measurements might be affected by direct sunshine, cold conditions, or a sweaty forehead.

IV. Conclusions

Following the completion of the proposed study, the researchers concluded that the prototype is effective based on the data obtained from the series of tests conducted. The device's overall performance and response time from the Website show that it is successfully capable of user registration to record its temperature and location upon scanning the barcode into the device. It is crucial and an excellent aid for faster real-time contact tracing.

The study's main objective was to develop a device to scan the user's barcode and design an automated system to perform a digital contact tracing for Carmexss Jeepney to find infectious people and help stop the spreading COVID-19 virus was met by the proponents. It was operated successfully after multiple trials of simulation and the hardware phases as well, and the aimed output has been obtained.

RECOMMENDATIONS:

- The study can be expanded upon by including more website features.
- The device may also include biometrics.
- Be improved in reducing its size if new space-efficient electronic components have been developed.

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