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Automated Temperature Reader and Hand Sanitation with Hand Dryer

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Abstract:

In this study design and development automated temperature reader and hand sanitation system is one strategy for preventing the spread of SARS-Cov-2 infections and minimizing the health and economic devastation the virus spread can inflict. The researchers seek to create a system that uses a single micro-controller that can served independently. The methods use are composed of Hardware , Simulation using protues and data collection.A single Arduino Uno, four submersible pumps with an ultrasonic sensor for each station, a water tank, a soap reservoir, a temperature sensor and a frame to house the system, and this system is entirely powered by Solar.

The system is first simulated in PROTEUS and a prototype is then built as per the design requirements. Tests show that all the requirements are met. Data on the amount of water and soap delivered to the user relative to the level of water and soap available in the respective containers are obtained. The total number of wash cycles that can be made from a full water container, as well as that for a full soap container, is inferred from the data. The total number of users that the system may serve per hour is also arrived at.

Finally, A prototype is then built to test and verify the system's actual operation and responses and thence to make the necessary adjustment of parameters to realize an acceptable performance level. Tests result shows are promising and give significant to contribution on monitoring the temperature and disinfecting the user hand. Photos of the built and tested prototype, a diagram of the initial system design concept, a screen capture of the control system software model, a schematic diagram of the control system, and the flowchart on which the Arduino script is developed. The operation and user-interaction of the actual system is also described.

Key Words: **Hand sanitation, Automated System, Covid 19 , Arduino, Proteus , Ultrasonic Sensor, Hygiene .Temperature sensors**

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I.INTRODUCTION

The spread of the dreaded and potentially deadly SARS-Cov-2 that causes COVID-19 has become a globalconcern in so short a time since it was first detected in Wuhan, China. In one of its recent daily updates onCOVID-19[1][2].The healthcare system and its staff are currently dealing with a global crisis that has led to difficulties with lifestyle, economy, and, most significantly, people's health. The world's largest pandemic, according to the World Health Organization, is the coronavirus. [3][4][5], and the rapid spread of it has created a risky and sensitivesituation. Medical professionals and governmental organizations devised preventive

measures and health procedures in response to its global spread in the hopes of eradicating its effects. Among these are the regular cleaning procedures using soap, fresh water, and alcohol.
In addition to the global pandemic, the nation's extreme lack of cleanliness results in limited access to and nonexistence of alcohol-based services. The crowds also rely on inexpensive manual hand sanitizers and water taps like faucets because automatic water faucets and sanitizers are uncommon. However, using them has two drawbacks. First, manual water taps require the user to open the handle and wash their hands before closing the handle again, polluting the handle and increasing the virus's ability to spread. [6]. Manual hand sanitizers, on the other hand, still allow the user to touch the parts of sprayers and/or bottles to sanitize their hands. [7][8]
Almost every country in the world closed their borders, even advised their citizen to stay at home, and most of the businesses are closed, and the worst effect most people lost their jobs and the unemployment rate increase. Due to the impact on the economy, countries now started to open their borders and businesses. They give advice protocols to follow. The use of non-contact automated hand wash with a hand dryer is one of the best strategies to eliminates or decrease the spread of coronavirus. Tests show that all the requirements are met. It follows perfectly the required handwash protocol from the WHO and drying of hands.[9]
The best method for avoiding the use of conventional contact thermometers and handheld devices is to utilize non-contact temperature and sanitizer dispensers. The measured temperature is displayed through the LCD and with a pilot lamp indicator if the reading is normal or above 38 degrees centigrade. Based on the collected data, the system demonstrates that the temperature measurement findings are accurate. The system aids frontline staff in monitoring temperature and providing alcohol to employees at any company. Since nobody will touch the pump and this system will only administer a small amount of alcohol every motion activation, it is an upgrade in the Sanitizer Dispenser that will make it easier to get rid of viruses.[10][11][12].

The Corona-Virus disease pandemic (COVID-19) poses a threat to human life. Lockdowns and curfews implemented to prevent the spread of the virus had an effect on students' ability to learn, their families' ability to make a livelihood, and their sense of safety in their homes and towns. Due to the pandemic, it is essential to practice appropriate hygiene to avoid the spread of the disease. Despite the persistent danger, several areas of the country have begun to ease restrictions. Due to these ease of restrictions, schools and institutions have been returning to face-to-face classes from online learning.

Despite the absence of sufficient sanitary facilities at Isabela State University Cabagan-College of Computing Studies Information and Communication Technology (ISU-CCSICT), students there still have contact with faucets, soap, and sanitizers, which is obviously detrimental and uncomfortable for them thus designing this temperature reader and hand sanitizer.

II. Methodology

The development of the automated temperature reader and hand sanitizer follows input-output process which has four-part methodology: formulation of the sanitary(temperature and ultrasonic sensor), operational, manufacturing and economic requirements; design, modeling, and simulation of the micro-controller-based control system; hardware prototype development; system test and data collection

2.1 Data Analysis and Statistical Tools

Several statistical tools and procedures were used to analyze and interpret the data obtained.

- **Frequency count.** This simple statistical tool was used in tallying the items.

- **Weighted mean**. This determined the frequency of responses to the items required from the options in the Likert scale needed to find the average level of the usability and functionality of Solar Powered Hand

Sanitation with Rain Catch Basin as an alternative water source.

- **ikert's scale**. To determine the level of functionality and usability of Solar Powered Hand Sanitation with Rain Catch Basin as an alternative water source. The researchers used the following 5 points on the Likert scale and their interpretation was used.

Table 1. **Likert's scale**

SCALE	DESCRIPTION	RANGE
5	Strongly Agree	4.21-5.0
4	Agree	3.41-4.20
3	Slightly Agree	2.61-3.40
2	Disagree	1.81-2.60
1	Strongly Disagree	1-1.80

2.2 Design Procedure

This section will go over the various phases used during the design project's development. The block diagram of the system will be presented and discussed.

2.2.1: Control System Design(System Flow Chart)

The design of the automated temperature reader and hand sanitizer control system is illustrated Fig 1

As shown below, the solar panel is the primary source of power supply of the system. In order to store power the study

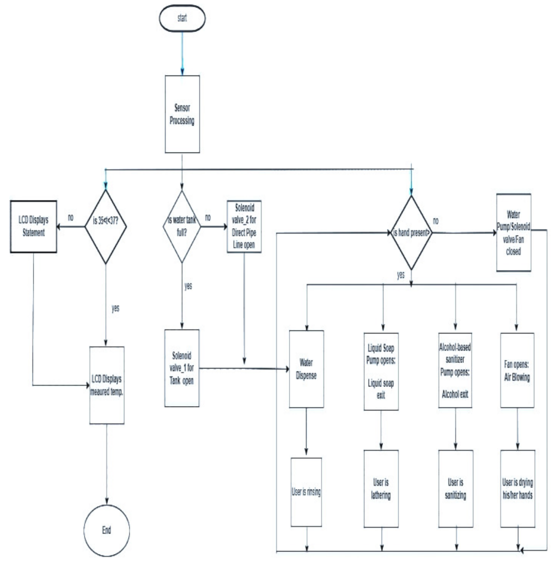

Figure 1 . System Flow chart

2.2.2 Control System Software Modeling and Simulation

The development of the automated temperature reader and hand sanitizer powered by solar hardware prototype is done in two stages. The first stage is embodied by the control system hardware implementation shown in Fig. 2, showing an Arduino Uno, 4 ultrasonic sensor, four pumps, 2 each for water and soap, 2 blower fan. The hardware is tested under the same cases carried out in the control system software simulation. The second and final stage involves the construction of the frame and the installation on it of the control system implemented and tested in the first stage. The water and soap tanks are put in place along with the flexible plastic tubes acting as the water and soap supply lines, The solar powered supply is designed based on the requirements of the system. The fan blower use as fan dryer one the user put his hand on the ultrasonic sensor.

Prototype Design Concept .

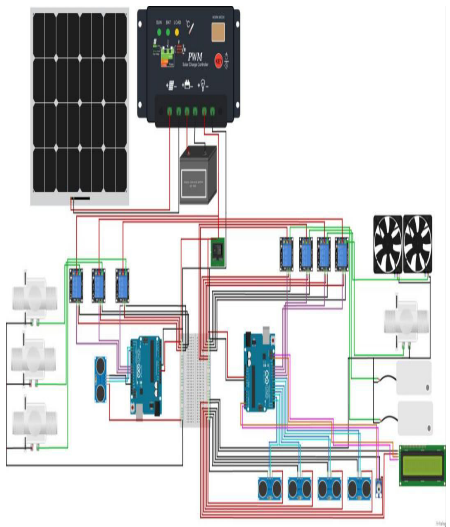

Figure 2. System Pictorial Diagram

2.3. 3D Design Concept

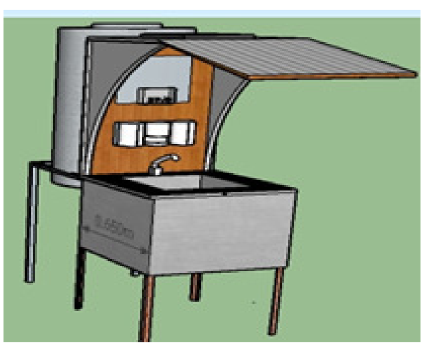

Figure 3. Design Concept

2.4Implementation , Testing and Prototyping.

During this stage, the researchers built a prototype out of materials like wood for the device's housing and other parts like sensors and Arduino to test the programs' correct operation. They then used the real modules and sensors to place them into the project's actual housing. The implementation of the solar-powered hand sanitizer with a rain catch basin as a backup water source and several modules, sensors, and motors. Throughout development, the project's usability, dependability, and usefulness were evaluated. In the meantime, program structures and algorithms were scrutinized in order to spot the mistakes and fix them, resulting in a system that works efficiently. Following development, a survey was distributed to users to ascertain their opinions of the device's reliability, usability, and functionality.

Figure 4: The Prototype

III. RESULTS AND DISCUSSION

Project Design

The solar panel was the main source of power in the system while the solar charger controller manages the current voltage supplied to the loads and any excessive energy can be transferred to the battery, ensuring that the batteries do not get overloaded. In the absence of sunlight, the battery is used to run the load. The Arduino Uno serves as the main memory while the relay is used as a switch for motor pumps and solenoid valves. In relation to this, sensors and relays were interfaced to the Arduino Uno in order to process the data and to attain the desired output.The circuit diagram connections of every device, starting from solar panel (main source of power), the I/O pins of Arduino and 5V relay (serves as a switch to motor pumps and solenoid valve) were shown in Figure 3.

The flowchart of the system shown in Figure 4 to elaborate more the flow of the system including components and codes. The flow of the system started with process of sensors. When the sensor of temperature system activated, the scanned temperature will be display on LCD.

The water tank will only open when tank is filled by rain water , otherwise the tank will be automatically close. Furthermore, if the user hands placed under the soap, sanitizer and water dispenser it will automatically dispense the liquid same goes with the hand dryer system.

The questionnaires were distributed to the respondents via Google form for functionality, to test the operation of the device, usability, to assess how the user used the device and reliability, the quality of the device, or how the device performed consistently well.An evaluation of Solar Powered Hand Sanitation with a Rain Catch Basin as an Alternative Water Source

Table 2. System Response

S- Simulation, H-Hardware , P- Prototype,

Result/System Response				
	Description	S	H	P
1	User Approaches within 5 cm to check for the temperature	W	W	W
2	User Within 20 cm in Hand Wash	W	W	W
3	Time for Soap Dispensing	W	W	W
4	Time for Water Dispensing	W	W	W
5	User Approaches Within 5 cm in hand dryer	W	W	W
6	Time for Hand Drying Dispensing	W	W	W

W- Working , SA- Strongly Agree

Table 3. Respondents' Rating on the Functionality of Device

FUNCTIONALITY	WM	DE
1. The device provides an automatic hand sanitation system.	4.73	SA
2. The sensors in a device energize when it detects the presence of hands.	4.77	SA
3. The device provides power supply through solar energy.	4.80	SA
4. When there is no enough water supply from the main water source the rain catch basin provides an alternative option.	4.60	SA
5. The rain catch basin filtered by rainwater.	4.53	SA
6. The sensors of the device can measures the presence of hands	4.63	SA
7. The temperature sensor can measures the presence of body or hand precisely and effectively displayed the scanned temperature.	4.5	SA
8. The Hand Dryer can provide air to dry the user hands	4.47	SA
9. The sensor of rain catch basin can measure the level of water.	4.5	SA
10. The automated hand washing can provide water coming from the rain catch basin or to the direct pipeline.	4.57	SA
Over all Weighted Mean	**4.61**	**SA**

Table 4. Respondents' Rating on the Usability of Device

USABILITY	WM	DE
The device is eco-friendly.	4.67	SA
The device helps prevent the widespread of any bacteria and viruses.	4.67	SA
The device provides user a better experience for sanitation.	4.67	SA
The device provides user a different process for sanitation.	4.50	SA
The device provides the user to access reusable water resources for sanitation.	4.63	SA
The device can be move from one place to another.	4.67	SA
The user can use the device without assistance or technical support.	4.7	SA
The user can easily learn the use of the device.	4.7	SA
The user would like to use this system frequently.	4.73	SA
The device is easy to use.	4.53	SA
Overall Weighted Mean	**4.65**	**SA**

Table 4 shows the mean perception of CCSCIT students at Isabela State University-Cabagan Campus in terms of the functionality of the device.

The respondents strongly agree that the device performs its desired function with an overall weighted mean of 4.61.

Table 4 shows the mean perception of CCSCI

The students at Isabela State University-Cabagan Campus in terms of the usability of the device. The respondents strongly agree that the device performs its desired function with an overall weighted mean of 4.65.

Table 5. Respondents' Rating on the Reliability of Device

RELIABILITY	WM	DE
1. The dispensing of water, soap and sanitizer were sufficient.	4.90	SA
2. The electronic panel box protects device circuits and components from moist.	4.27	SA
3. The temperature sensor measures correct temperatures each time it is used.	4.87	SA
4. The sensors of the device measures distance accurately each time it is used.	4.77	SA
5. The materials used in the hand sanitation kiosk is strong enough to support the features of the device.	4.73	SA
6. The device can be a long-time use	4.70	SA
7. The features of the device works consistently	4.63	SA
8. The amount of blowing for hand dryer is sufficient	4.37	SA
9. The solar panel stores power and constantly power the system.	4.67	SA
10. The water dispenser continuously dispense the water each time it is used.	4.52	SA
Overall Weighted Mean	**4.64**	**SA**

Table 5 shows the mean perception of CCSCIT students at Isabela State University-Cabagan Campus in terms of the reliability of the device. The respondents strongly agree that the device performs its desired function with an overall weighted mean of 4.64.

IV. CONCLUSION

The Solar Powered Automated Temperature Reader and Hand Sanitation with Hand Dryer has successfully satisfied with the excellence performance of the device upon completion of the evaluation, the respondents' perception of the system indicated that it is functional, useful, and reliable and being and the objectives of the study able to fulfill all the stated features and was achieved by combining all of the required components for the design project, such as the automated soap, sanitizer, and water dispensers, the hand dryer, and the temperature monitoring.

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