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SMART Fire Detection System: Design and Implementation

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Abstract: The purpose of the study was to develop a SMART Fire Detection System as an alternative to existing expensive automatic fire control systems. Moreover, it expedites emergency responders to quickly respond to fire events and reduces the likelihood of false fire alarm reports. The study uses a descriptive research method that underwent survey questionnaires to measure its acceptability level. The system underwent testing and demonstrations in selected barangays and at Cebu Technological University-Main Campus before surveying respondents on its performance, reliability, serviceability, and safety. The SMART Fire Detection System received a highly acceptable rating, indicating its effectiveness in providing quicker emergency alerts and responses while reducing false alarms. The system can be built using materials readily available in the local market. Moreover, it is recommended, it is also recommended to add more hybrid detectors in order for the system to cater more to areas/rooms. The overall data suggest the project meets the demand for quicker emergency alerts and responses.

Keywords: emergency response, fire detection system, product acceptability, smart technology, wireless communication

I. INTRODUCTION

In today's generation, where innovation is rapidly increasing, safety is one of the top priorities, for households, institutions, and even on the business industry. Based on the data that BFP gathered in the year 2018, the total number of fire incidents in the Philippines alone that they responded to reached 14,197 cases. In the year 2019, the recorded cases were 18,612, and in the year 2020, 14,420 cases were recorded, which is -22.52% lower than the same period of a month in the year 2019. For the year 2021, the cases are once again lower than in the year 2020, which only has 12,850 recorded cases (-10.88%). For the year 2022, for the first 3 months of the year, from January until March, the recorded fire cases also decreased by -34.9% (811 cases) compared to the first 3 months of the year 2021, that has 1,245 recorded cases.

Based on this data, it only shows that as time passes by, the innovation in today's generation is indeed effective in terms of fire safety and protection, but even though the new devices that have been created cannot still solve the huge number of these fire incidents. Buying devices to detect smoke and heat separately is expensive for every establishment. The researchers are proposing ways to overcome these problems and to upgrade fire device problems.

As much as fire needs to be extinguished as soon as possible, early identification and detection of fire are equally important in terms of safety and getting help to those who need it. It is also vital to identify potential hazards as soon as they appear so that lives can be saved, the property can be protected, and emergency response efforts can start as soon as possible.

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Most of the alarm systems function by sending alert signals to emergency responders from the scene of the fire. However, this method—which has been widely used—is inefficient in a way that time will be consumed by the process of alerting stations for fire responders. As a result, by the time responders arrive at the site, the loss might be substantial or huge.

Fires are not only deadly but also detrimental to property and human safety in both the workplace and the home. Quick action in an emergency scenario is key to minimizing damages. Therefore, self-contained, automated fire detection systems are required. Also, it is the job of these systems to spot fires quickly, sound alarms, and even put out blazes in certain cases. With that, the systems will be equipped with smoke, temperature, and pyro-electric sensors—that, with the help of a processing unit—can promptly warn to take preventative actions. If these potentially deadly scenarios can be identified and warned of sooner rather than later, fewer lives and belongings will be lost.

Moreover, the fire detection system is the most essential aspect of any building's architecture. As an example, hotels and hospitals require very advanced planning for the installation of these systems due to the complexity of their architecture. These technologies are designed to detect fires in their early stages of detection.

Given this, Healey et al. (1993) presented a method for real-time fire detection using color video by using the spectral, spatial, and temporal features of fire. Numerous studies have been conducted on the use of robots for firefighting detection, and Amano et al. addressed one such robot with vertically riveted moving railings.

Independent mobile robots that can traverse a labyrinth hunting for a fire (represented by a burning candle) were studied by Verner et al. and Pack et al. In these experiments, the robots would find the fire, put it out, and then go back to where they started.

San-Miguel-Ayanz et al. examined the use of the mid-infrared and thermal bands of sensors onboard aerial stages and satellites for the detection of intense surface fires.

Thus, this study aims to assess the acceptability of the SMART Fire Detection System, aiming for a faster detection and response from emergency responders in case of a fire.

II. METHODOLOGY

The descriptive survey approach was used to conduct this research. This research aimed to evaluate the acceptability of the design and progress of a SMART Fire Detection System.

Design

The descriptive survey approach was utilized in this study to assess the preparedness and effectiveness of emergency response coordination among city responders, barangay responders, and school personnel of Cebu Technological University–Main Campus. This method is appropriate because it allows for the systematic collection and analysis of data to describe the current conditions and relationships among the involved groups without manipulating any variables.

Participants

The study involved 50 respondents composed of three key groups directly related to emergency response and school safety. These included 20 city responders and 20 barangay responders from Barangay Tejero, Barangay San Roque, and Barangay Sto. Niño, each representing 40% of the total participants. Additionally, 10 respondents, or 20% of the group, were personnel, faculty, and security staff from Cebu Technological University–Main Campus. This combination of participants ensured diverse insights from local government units, city authorities, and school representatives, providing a well-rounded perspective for the research.

Locale

The study was conducted at Cebu Technological University-Main Campus in M.J. Cuenco Ave, Cor R. Palma Street, 6000 Cebu. It is considered the environment of the study because it is one of the most populated colleges in Cebu City. Moreover, there are three Barangay near the environment that has fire stations making it a feasible environment to conduct the study.

Instrument

In this study, the instrument used to elicit and collect information will be in the form of a questionnaire constructed by the researcher. The researchers used questionnaires as tools to measure the acceptability of the device using Garvin's Eight Dimensions of Product Quality.

Data Analysis

The data gathered from the completed questionnaires will be carefully tabulated, compiled, and subjected to

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statistical analysis to ensure accurate interpretation of the findings. To evaluate the respondents' perceptions and levels of preparedness, the weighted mean was used as the primary statistical tool, allowing the researchers to determine the overall assessment based on the frequency and weight of each response. Percentages were also computed to show the proportion of responses for each category in relation to the total number of respondents, making the distribution of data easier to understand. These statistical treatments were provided a clear and systematic analysis of the results, enabling the researchers to draw meaningful conclusions and formulate recommendations based on the study's objectives.

Ethics

This study was conducted in strict adherence to research ethical standards to ensure the safety, rights, and dignity of all participants. Approval to conduct the research was first obtained from the Chairman of the Department of Mechatronics, and authorization was secured before administering the questionnaires. Participation was entirely voluntary, and respondents were informed of the purpose and goals of the study prior to data collection. Their consent was sought, and they were assured of the confidentiality and anonymity of their responses—no names, personal identifiers, or tracking information were recorded. Participants were also informed that they could decline to answer any question or withdraw from the study at any time without any consequence. All data collected were treated with utmost care and used solely for academic purposes, ensuring that the findings represent honest insights while protecting the respondents' privacy and well-being.

III. RESULTS

This portion presents analysis and interprets the data gathered by the researchers. This study was based on both survey questionnaires for the following respondents: Barangay Officials and Barangay Responders of Brgy. Tinago, Brgy. Sto. Niño, and Brgy. Tejero, Cebu Technological University personnel and students. The tables and charts presented are in accordance with the order being stated in the Statement of the Problem.

1.0 Technical Requirements

Operational Flowchart

The physical appearance design of the machine was the starting point for the technological needs in creat of the SMART Fire Detection System. The prototype process comprises project preparation, which includes developing the circuit diagram, schematic diagram, canvassing of the components, tool preparation, and material testing. After the construction was completed, the project was thoroughly checked for possible open or short circuits, then it was powered up to check for voltage drops of the power supply, hardware revision of the circuit was also done during this stage, and in the programming process, a software-based program was used to write the assembly language. The entire procedure is depicted in the schematic displayed in Figure 1.

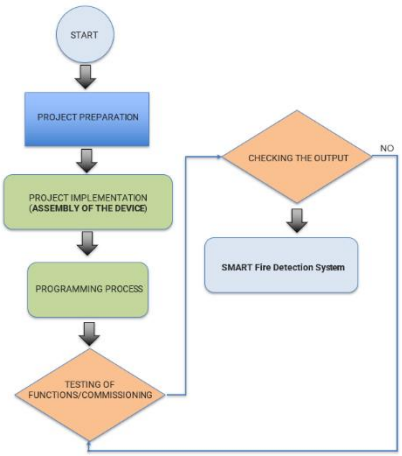

Figure 1

The specification of the process in the operational flow chart begins with project preparation, which involves careful planning, designing, and preparing the necessary tools and equipment. This stage includes creating

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detailed schematics, selecting appropriate hand and power tools, preparing and organizing testing equipment, and canvassing materials to ensure quality and cost-effectiveness. Following preparation is the project implementation, which focuses on the assembly of the device. Key activities during this stage include cutting, drilling, welding, soldering, and wiring, all performed systematically to ensure accuracy and functionality. The final stage is testing of functions, which ensures that the assembled device operates correctly and meets the desired specifications. This stage involves programming and, if necessary, re-programming the system, conducting multiple test-runs to verify performance, and documenting the outcomes for evaluation and future reference. Together, these steps provide a clear and organized workflow for achieving a well-constructed and functional project.

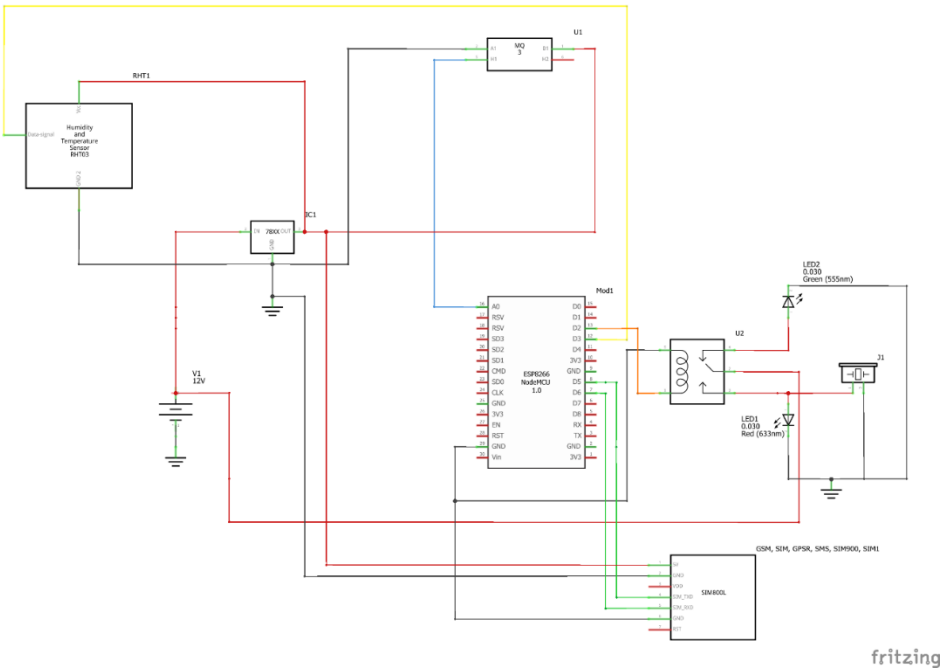

Figure 2. Transmitter Schematic Diagram

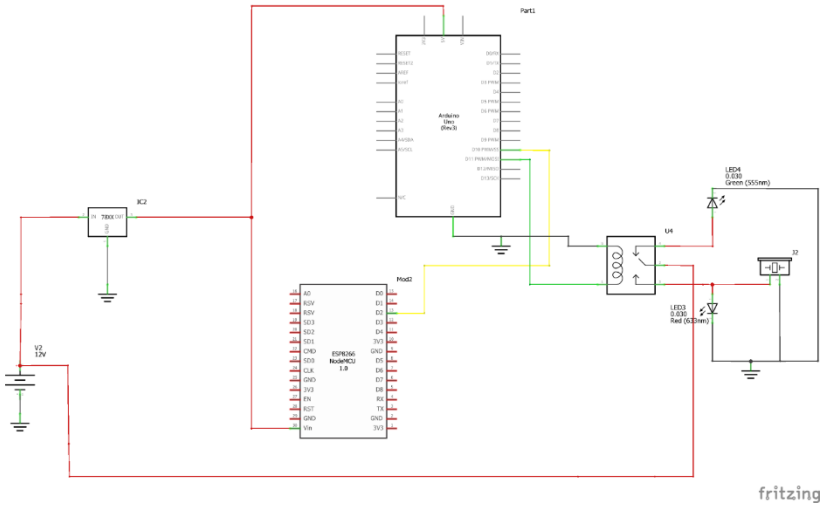

Figure 3. Receiver Schematic Diagram

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MATERIALS AND EQUIPTMENT

The materials used in the development of the SMART Fire Detection System are all available in the local market. The researchers used reasonable prices of materials, and these were carefully selected so as not to compromise the quality of the project. Table 1 and Table 2 show the Bill of Materials while Table 3 also shows the tools needed in the construction of the SMART Fire Detection System.

Table 1
Billing of Materials of electrical/electronic components of the Smart Fire Detection System
ELECTRICAL / ELECTRONIC COMPONENTS

MATERIALS	QUANTITY	COST
Solar cell panel	1 pc	Php 500
Automotive wire #18	20 meters	Php 300
MCB 16A 2 pin Clint	1 pc	Php 250
MCB 20A 2 pin Himel	1 pc	Php 250
Multi-core Shielded wire	5 meters	Php 150
MPPT Wind Turbines Charge Controller 500-1000W 12V Auto Waterproof	1 pc	Php 1,400
NSS 12V 12AH Sealed lead-acid battery can be connected to inverter to power	2 pcs	Php 2,290
DC motor 24V 250W	1 pc	Php 890
Electrical Junction Box	1 pc	Php 24
Terminal log	4 pcs	Php 36
SIM800L V2 5V wireless GSM GPRS Module	1 pc	Php 350
2 Channel 5V Relay module SPTD	2 pcs	Php 160
NodeMCU 3V Lua Wifi Development Board ESP8266	1 pc	Php 200
One way channel relay	1 pc	Php 109
LM7804	2 pcs	Php 40
Power jack 12V	2 pcs	Php 30
PCB Board	1 pc	Php 50
LED light green and red	2 pcs	Php 4
Resistor 10K ohms	1 pc	Php 9
Industrial buzzer 20V	2 pcs	Php 130
Solar Charge Controller	1 pc	Php 265
Indicator LED light red and green	4 pcs	Php 180
15A Terminal block molded type Electrical TB-1504	5 pcs	Php 175
DHT22 Temperature and Humidity Sensor module	1 pc	Php 250
MQ 5 Gas sensor	1 pc	Php 100
Total cost of electrical components:	-	Php 8,142

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Table 2
Billing of Materials of structural materials of the Smart Fire Detection System
STRUCTURAL MATERIALS

MATERIALS	QUANTITY	COST
Sherlux spray paint black	2 pcs	Php 230
Stikwell wood glue	1 pack	Php 70
Stainless hinge 4S 78822	4 pairs	Php 200
Metal Screw #8x 1/2	6 pcs	Php 6
Blind rivets 5/32 x 5/16	14 pcs	Php 10.50
Angle bar 1/8 x 1x 6m	2 LGT	Php 600
Plain aluminum sheet	3/4 sheet	Php 390
Bike rim set	2 set	Php 300
Total cost of Physical Materials	-	Php 1,806.50
Total cost of Physical and Electrical	-	Php 9, 948.50

Table 3
List of Tools and Equipment Used in the construction of SMART Fire Detection System

ITEM	**DESCRIPTION**
Hand riveter	Used to tape the metal sheet.
Grinder	Used to cut metals and polish the surfaces.
Drill	Used to make a hole or enlarge circular holes in solid materials.
Welding machine	Used to weld the steel to the body of the machine.
Flat/Philip screwdriver	Used to tighten or loosen the screws.
Screws	Are used to hold things together, especially in wood.
Multitester	Used to test the electric components.
Bolts	Used to fasten the metal securely together.
Nuts	Are used to attached to a bolt to secure and prevent from moving.
Soldering Iron	Used to apply a small quantity of flux to a joint
Personal Laptop with Arduino IDE	Used to compile and upload the program codes to the microcontroller

POWER CONSUMPTION

The power consumption consumed by the SMART Fire Detection System is in line with the power supplied by the rechargeable battery. Table 4 shows the power consumed by the Transmitter Control Panel, whereas Table 5 shows the Power Consumption of the Receiver Control Panel. Both total Current Consumption was multiplied by 2.5 in order to get the maximum consumption.

Table 4
Power Consumption of Transmitter Control Panel

Components	Power Consumption
NodeMCU ESP8266	1 watt
MQ2 Gas Sensor	0.75 watt
DHT22 Temperature Sensor	0.5 watt

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SIM800L V2	20 watts
2-Channel Relay Module	0.70 watt
Piezoelectric Buzzer	0.36 watt
Indicator Lamp (Green)	0.24 watt
Indicator Lamp (Red)	0.24 watt
Voltage Regulator 7805 IC	0.6 watt
TOTAL	24.39 watts

Table 5
Power Consumption of Receiver Control Panel

Components	Power Consumption
NodeMCU ESP8266	1 watt
1-Channel Relay Module	0.35 watt
Arduino Uno	0.2 watt
Piezoelectric Buzzer	0.36 watt
Indicator Lamp (Green)	0.24 watt
Indicator Lamp (Red)	0.24 watt
Voltage Regulator 7805 IC	0.6 watt
TOTAL	2.99 watts

2.0 ACCEPTABILITY OF SMART FIRE DETECTION SYSTEM

Perceived by the experts and ordinary individuals the following tables shows the acceptability level of quality in terms of Performance, Reliability, Serviceability, and Safety, which were polled by the selected experts.

2.1 Performance

The term performance refers to the product's primary operating characteristics. The data gathered from the respondents are shown in Table 6.

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Table 6
Acceptability as to Performance
N=50

PERFORMANCE	**HA (5)**	**MA (4)**	**FA (3)**	**LA (2)**	**NA (1)**	**μ**	**VD**
1.1.1 Fast Detection of fire.	46	4	-	-	-	4.92	HA
1.1.2 The IoT feature works and can send data over the internet.	46	4	-	-	-	4.92	HA
1.1.3 The machine is capable for a faster emergency response.	46	4	-	-	-	4.92	HA
1.1.4 The GSM feature can alert registered phone numbers timely.	43	7	-	-	-	4.86	HA
1.1.5 Communication between two control systems.	44	6	-	-	-	4.88	HA
1.1.6 Renewable energy resources.	42	8	-	-	-	4.84	HA
1.1.7 Sufficient supply of power supply.	44	6	-	-	-	4.88	HA
1.1.8 The hybrid detector readings are timely and accurate.	47	3	-	-	-	4.94	HA
1.1.9 The machine is consistent in giving accurate data.	43	7	-	-	-	4.86	HA
1.1.10 The alarm indicators (LED & Buzzer) are audible and visible.	44	6	-	-	-	4.88	HA
Average Percentage	89%	11%	-	-	-	-	-
Average Weighted Mean						4.89	HA

The table above shows the result of the performance of the device from the selected 50 respondents. Here, every question pertaining to the performance of the device is rated as **Highly Acceptable.** It was then found out that the device's performance level based on the result has an average weighted mean of **4.89** and a verbal description of **Highly Acceptable.**

The table also shows that an average of **89%** of the selected respondents rated **Highly Acceptable,** and

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11% rated **Moderate Acceptable.** In general, this indicates that the Smart Fire Detection System meets the respondents' needs in terms of performance and is occupied as **Highly Acceptable.**

2.2 Reliability

Reliability is the unique quality of a product that supplements its functionality. The data gathered from the respondents are shown in Table 7.

Table 7
Acceptability as to Reliability
N=50

RELIABILITY	**HA (5)**	**MA (4)**	**FA (3)**	**LA (2)**	**NA (1)**	**μ**	**VD**
1.2.1 The machine responds accordingly when a signal is present.	45	5	-	-	-	4.9	HA
1.2.2 The Machine can operate continuously.	44	6	-	-	-	4.88	HA
1.2.3 The machine is eased to operate and understand.	43	6	1	-	-	4.84	HA
1.2.4 The renewable energy sources can withstand the machine's power consumption.	43	7	-	-	-	4.86	HA
1.2.5 Long operation.	37	13	-	-	-	4.74	HA
1.2.6 Readings of the hybrid detector are reliable.	43	7	-	-	-	4.86	HA
1.2.7 Can maintain accurate readings.	39	10	1	-	-	4.76	HA
1.2.8 SMS and call alert functions immediately.	43	7	-	-	-	4.86	HA
1.2.9 Alarm will be triggered when the fire is detected.	44	5	-	1	-	4.84	HA
1.2.10 The machine can withstand on harsh weather conditions. (e.g., too sunny/high-level temperature)	36	14	-	-	-	4.72	HA
Average Percentage	83.4%	16%	.4%	0.2%	-	-	-
Average Weighted Mean						4.826	HA

The table above shows the result of the second criterion to be determined in the survey was the reliability of the device from the selected 50 respondents. The majority of the reliability-related questions are rated as **Highly Acceptable**. It was then found out that the device's reliability level based on the result has an average weighted mean of **4.826** and a verbal description of **Highly Acceptable.**

The table shows that an average of **83.4%** of the selected respondents rated **Highly acceptable**, followed by **16%** rated **Moderate Acceptable**, **0.4%** rated **Fairly Acceptable,** and the remaining **0.2%** for **Less Acceptable.** Overall, this means that the Smart Fire Detection System satisfies the respondents' needs in terms of features and is considered is **Highly Acceptable.**

2.3 Serviceability

It is defined as the speed, courtesy competence, and ease of repair. The data gathered from the respondents are shown in Table 8.

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Table 8
Acceptability as to Serviceability
N=50

SERVICEABILITY	**HA (5)**	**MA (4)**	**FA (3)**	**LA (2)**	**NA (1)**	**μ**	**VD**
1.3.1 Ease to maintain.	40	10	-	-	-	4.8	HA
1.3.2 The machine's equipment and component parts are locally accessible.	46	4	-	-	-	4.92	HA
1.3.3 Both machine's battery is chargeable.	44	6		-	-	4.88	HA
1.3.4 Components are replaceable.	44	6	-	-	-	4.88	HA
1.3.5 Machines are repairable.	45	5	-	-	-	4.9	HA
1.3.6 The components are well-organized and are labeled accordingly.	42	8	-	-	-	4.84	HA
1.3.7 The machine's program/code instructions are provided.	44	4	1	1	-	4.82	HA
1.3.8 Commissioning Manual can easily be understood.	45	5	-	-	-	5	HA
1.3.9 The machine's maintenance manual are provided.	46	4	-		-	4.92	HA
1.3.10 The machine's Operational Manual can be accessed and understandable.	43	7	-	-	-	4.86	HA
Average Percentage	87.8%	9.8%	.2%	.2%	-	-	-
Average Weighted Mean						4.88	HA

The third criteria to be determined in the survey was serviceability and the table above shows the result of the serviceability of the device from the selected 50 respondents. Here, most of the questions pertaining to the serviceability of the device are rated as **Highly Acceptable**. It was then found out that the device's serviceability level based on the result has an average weighted mean of **4.88** and a verbal description of **Highly Acceptable.**

The table also shows that an average of **87.8%** of the selected respondents rated **Highly Acceptable**, **9.8%** of them rated **Moderate Acceptable**, **.2%** of them rated **Fairly Acceptable**, and the remaining **.2%** rated **Less Acceptable.** Overall, this suggests that the Smart Fire Detection System meets the respondents' needs in terms of serviceability and is considered as **Highly Acceptable**.

2.4 Safety

The product's capacity to be safe for its intended usage. The data gathered from the respondents are shown in Table 9.

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Table 9
Acceptability as to Safety
N=50

SAFETY	**HA (5)**	**MA (4)**	**FA (3)**	**LA (2)**	**NA (1)**	**μ**	**VD**
1.4.1 All machine parts are used properly.	46	4	-	-	-	4.92	HA
1.4.2 The machine has an emergency off switch in case of malfunction.	42	8	-	-	-	4.84	HA
1.4.3 Electronic components are well-protected on a closed enclosure.	39	10	-	1	-	4.74	HA
1.4.4 Components are well-organized and tagged/labeled accordingly.	40	7	1	2	-	4.7	HA
1.4.5 Utilizes low voltage supply.	44	6	-	-	-	4.88	HA
1.4.6 Battery's power voltage is in line with what the machine's system requires.	44	6	-	-	-	4.88	HA
1.4.7 The panel box is placed in a secure location to avoid falling and injuring someone.	46	3	1	-	-	4.9	HA
1.4.8 Free from electric shock hazards.	43	7	-	-	-	4.86	HA
1.4.9 Components are well mounted.	41	8	1		-	4.8	HA
1.4.10 Machine is equipped with a safety precaution notice.	45	5	-	-	-	5.5	HA
Average Percentage	86%	12.8%	.6%	.6%	-	-	-
Average Weighted Mean						4.90	HA

The last criterion to be determined in the survey was safety and the table above shows the result of the safety of the device from the selected 50 respondents. It was then found that the device's safety level has an average weighted mean of **4.90** and a verbal description of **Highly Acceptable.**

The table also shows that an average of **86%** of the selected respondents rated **Highly Acceptable,** followed by **12.8%** of them rated **Moderately Acceptable**, **.6%** rated **Fairly Acceptable,** and the remaining **.6%** rated **Less Acceptable.** Overall, this suggests that the Smart Fire Detection System satisfies the respondents' needs in terms of safety demands and is considered **Highly Acceptable**.

Summary of the Acceptability in the Development of Smart Fire Detection System

Shown in Table 10 is the overall result of the acceptability level of the Smart Fire Detection System in terms of its Performance, Reliability, Serviceability, and Safety. This includes the summary of statistical analysis in each criterion.

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Table 10
Overall Summary of Acceptability

Criteria	**HA (%)**	**MA (%)**	**FA (%)**	**LA (%)**	**NA (%)**	**μ**	**VD**
2.1 Performance	89	11	-	-	-	4.89	HA
2.2 Reliability	83.4	16	0.4	0.2	-	4.83	HA
2.3 Serviceability	87.8	9.8	0.2	0.2	-	4.88	HA
2.4 Safety	86	12.8	0.6	.6	-	4.90	HA
Overall Percentage	86.55	12.4	.3	.2	-	-	-
Overall Average Weighted Mean						4.88	HA

The table above shows that overall average weighted mean of the device is 4.88 and fall under the verbal description of Highly Acceptable. The table also shows the breakdown of the overall percentage ratings in which 86.55% of the selected respondents rated Highly Acceptable, 12.4% of them rated Moderately Acceptable, .3% of them rated Fairly Acceptable, and .2% rated Less Acceptable.

Thus, this overall acceptance decision of the Smart Fire Detection System as the performance, reliability, serviceability, and safety is highly accepted.

IV. DISCUSSION

The acceptability of the SMART Fire Detection System as perceived by the respondents was interpreted using the statistical method. Based on the gathered data of the researchers, the acceptability as to the performance of the SMART Fire Detection System was rated majorly by the respondents as Highly Acceptable with an average weighted mean of 4.89. It was also found that the hybrid detector readings are timely and accurate, with an average weighted mean of 4.94 as shown in Table 8.

As per the acceptability of the device as to its reliability, data offers that most respondents accept that the machine responds accordingly when a signal is present. This shows that the device is reliable sending alert signals to nearby receivers.

Thus, the overall acceptability of the SMART Fire Detection System was highly acceptable, with a weighted mean average of 4.88.

The researcher found that the functionality of the SMART Fire Detection System was successful and satisfied the rate of the respondents after trying the machine to perform its function and achieving the study's objective.

This study developed a SMART Fire Detection System thus is capable of performing the essential functions of an automatic fire detection control system as an alternative. Most automatic fire control systems are relatively expensive; thus, the researchers wanted to develop an alternative approach.

The study uses a descriptive research method that underwent survey questionnaires to measure its acceptability level. Specifically, it sought the construction requirements of the SMART Fire Detection System, where the first process was the planning of the project design, schematic diagram, canvassing of materials and equipment, and preparing the tools for programming the machine. The cutting and welding of the materials, the installation of the components, programming, and troubleshooting of the project after completion. The assembly occurred after checking any open or closed circuits, checking the correct installation of the wires, and programming the microcontroller and sensor.

It also sought the acceptability level of SMART Fire Detection System as perceived by the respondents in terms of performance, reliability, serviceability, and safety. The data gathered were treated and analyzed as the result of the study.

V. CONCLUSION

In present days, a lot of fire accidents are occurring and are reported. Since reports to the fire rescue or emergency help personnel, the percentage of life loss and property loss is considerably high. The reason for delays in informing and getting the fire rescue services or emergency help personnel during an accident.

The researchers concluded that based on the overall performance of the SMART Fire Detection System, which resulted in the category of Highly Acceptable with a weighted mean of 4.88 satisfies the need to provide faster emergency alerts and response. Therefore, utilizing this system can lower the possibility of more casualties.

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Furthermore, based on the findings, the SMART Fire Detection System can be built and designed at a low cost with the materials found in a local market without compromising the quality of the machine, which allows it to perform field operations according to its use. In this way, making and producing such devices is more efficient and economical.

So, by adopting the proposed system, we can alert the surrounding people and inform responders regarding the accident along with the accurate location of the accident area specified. Hence this is an era of automation. The proposed system is apt for the environment and to ensure the safety of all.

VI. RECOMMENDATION

For future research and further improvements of the SMART Fire Detection System, the proponents recommend that future researchers should look for other lighter materials. This can make the device much more portable to transfer from one place to another, in additional enclosure housing for the components. Furthermore, it is also recommended to add more hybrid detectors in order for the system to cater more area/rooms. It can also be adopted and utilized in early detection of possible fire causing gasses for the device can also detect LPG, Alcohol, Propane, Hydrogen, CO and even methane gasses.

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