

Centralized Fire Locator System Through Iot-Based Fire Alarm System In Selected Barangay In Taguig City

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Article info

Received 22 th December 2021

Received in revised form 18 February

2022 Accepted 21 March 2022

Keywords

IOT Fire Alarm System,
Monitor Real-Time Status, Early
discovery

Abstract

This project aimed to develop a system that would easily locate the area of a fire in selected barangay Taguig City. The system allows the fire authorities to monitor the real-time status of a fire alarm and will be informed once the sensor devices modify a threat of fire. The system will also provide the information and location needed by the fire authorities to contact the owner of the house and prepare for a quick rescue. Early discovery of a fire may lead to the saving of many lives and properties. The researchers utilized a design method to identify the processes that were used during the project's development in this study. In addition, an ISO 25010 model was applied in this study to help participants in investigating and evaluating the developed system. In this study, the researcher conducted a survey in the form of a questionnaire, which was distributed to the target respondents by personal interaction. In order to develop the Centralized Fire Locator System through IOT-Based Fire Alarm System in Selected Barangay in Taguig City, the researcher used a model Agile methodology in the development of the project. The survey questions focused on the functionality of the created project, such as emergency notification, which is important in the making of this project. The target respondents had a positive interpretation of the system's efficiency and effectiveness. The three groups, including the IT practitioner, mostly responded with "Very Satisfactory" and "Excellent," indicating that they agreed on functionality, performance, usability, portability, and maintainability as outlined in the checklist instrument.

I. INTRODUCTION

PROJECT CONTEXT

Fire is one of the inherent risks that all homeowners encounter. In the unexpected event of a fire, you eventually lose most of your belongings and sometimes even a person. Yet, having a fire alarm system installed is a great way to keep you and your property safe. The system provides early warning of the fire, allowing enough time to evacuate the premises and inform authorities before the fire spreads out of control. When the sensor device detects a fire threat, it will automatically trigger the fire alarm to alert or give a warning to both the individual and the fire service.

The Internet of Things (IoT) is rapidly changing the way we live and work in the modern-day. People benefit from utilizing the internet because it allows them to communicate and perform transactions more effectively. The Internet of Things (IoT) is a global collection of devices that can be accessed over the internet. Because of the availability of low-cost hardware and dependable wireless communication methods, it is now possible to connect a wide range of

physical objects all over the globe to the internet to collect, different types of data that may be received, shared and even analyzed.

A flame sensor will be used in this system to identify a potential fire. A GPS gadget may be used to track the position of a fire that has been detected. The MQ-2 sensor detects smoke from a fire. The ESP8266 module has access to a WiFi network and a Piezo buzzer to provide a warning to every individual.

As researchers, We've noticed an increase in fire incidents in Taguig City, especially after the epidemic started. We also observed that firefighters are having difficulty getting to the exact location of fires and that some people forget to inform the fire department in the middle of their panic and fright, allowing the fire to spread and the situation to worsen. We responded by suggesting a system that would be beneficial to them. Proposing a study that uses an IoT-based fire alarm system will help them inform the barangay and fire department about the situation and respond immediately to save lives and properties.

II. LITERATURE REVIEW

Based on the information gathered by the researcher, IOT fire alarms have been very popular and beneficial in the event of a fire. An IoT fire alarm only needs the internet to transmit data from the sensors directly to the fire department. A Fire Alarm System with a location using IoT It was developed by Venkatesh, M., and Hemanth, M. (2019). The developed system was designed to meet two main requirements: the protection of property and assets and the protection of life. The primary goal of a fire alarm system is to give early notice of a fire so that people may be evacuated from the area where the fire is burning and prompt action can be taken to put out the fire. According to Menchita F. Dumlao, Ph.D. (2016), the study, Fire Alarm Systems Based on Internet of Things technologies, it aims to develop innovations for the Bureau of Fire Protection (BFP) on how to monitor city buildings and establishments and reduce the burden on owners and BFP personnel. The students from Manila also developed an IOT fire alarm called FLAMES. According to them, the Internet of Things (IoT) is a new technology that connects gadgets and sensors wirelessly over the Internet. The user will be alerted of fire danger warnings via the app, which will also be forwarded to the Bureau of Fire Protection (BFP) for a faster response to fire incidents. Through its alarm system, the device would not only enhance the effectiveness of fire prevention but also the reliability and reaction time of firefighters. This proves that the proposed study by the proponents is reasonable as it has relevance to the reviewed literature and studies. The cited literature and studies give ideas and additional knowledge to the proponents on how to implement the project and continue doing it.

III. RESEARCH METHODOLOGY

The researcher applied the descriptive and developmental research that is required for the proposed study. The researcher used the descriptive-survey method, which describes the assessment of the respondents on the Fire Alarm in Taguig City and the evaluation of the two groups of respondents to the proposed study Centralized Fire Locator Systems through IOT Based Fire Alarm System in Selected Barangays in Taguig City.

For this study, the researchers used the project development process to support the development of this study. This study was developed with the help of Agile methodology. The Agile methodology serves as a guide for the development of a system, taking you step-by-step through the process. The agile technique generates high-quality, well-designed, and contrasting systems.

The researcher created a questionnaire to evaluate the effectiveness of fire alarms in Taguig City's selected barangays. While the proposed system was evaluated using standardized questionnaires (based on ISO/IEC 25010),

The purposive sampling technique was used in this study, specifically in choosing the participants and conducting the survey questionnaires. The target respondents were those who

had prior experience in fighting a fire, such as fire personnel and barangay officials. The system will be evaluated using ISO/IEC 25010 by a total of 24 fire personnel, 25 barangay personnel, and 12 IT practitioners.

IV. FINDING AND DISCUSSION

The salient findings of this research are synthesized in this section

1. Evaluation of the respondents on the Effectiveness of Early Detection and Fire Alarm

Table 1.
Respondent’s Assessments for Early Detection

Indicators	Fire Department Personnel		Barangay Personnel		IT Practitioner		Average	
	W. M	Interpret	W.M	Interpret	W. M	Interpret	W. M	Interpret
Early discovery of fires is effective to prevent damage from spreading.	3.88	Very Satisfactory	3.64	Very Satisfactory	3.83	Very Satisfactory	3.80	Very Satisfactory
Early detection of fires is effective for early evacuation.	3.88	Very Satisfactory	3.68	Very Satisfactory	3.75	Very Satisfactory	3.77	Very Satisfactory
Early detection of fires is effective for activating devices and alerting individuals.	3.92	Very Satisfactory	3.64	Very Satisfactory	3.83	Very Satisfactory	3.78	Very Satisfactory
Identifying the threat of fire early was effective in order to inform the fire service and respond quickly.	3.76	Very Satisfactory	3.76	Very Satisfactory	3.83	Very Satisfactory	3.72	Very Satisfactory
Detecting fire at an early stage is effective in order to avoid losing property.	3.84	Very Satisfactory	3.56	Very Satisfactory	3.75	Very Satisfactory	3.78	Very Satisfactory
Overall Weighted Mean	3.86	Very Satisfactory	3.66	Very Satisfactory	3.80	Very Satisfactory	3.77	Very Satisfactory

Table 1. shows that the overall over-weighted mean of the indicators has a rating of **3.77**, which is interpreted as **"Very Satisfactory."** It also shows that both fire department personnel, barangay personnel, and IT practitioners answered the questions with "Strongly Agree." It can be seen that the fire department personnel garnered a higher rate of **3.86** compared to the barangay and IT practitioners, who only obtained 3.66 and 3.80. It is also shown that the question **"Early discovery of fires is effective to prevent damage from spreading."** garnered the highest rating of **3.80**, which is interpreted as **"Very Satisfactory,"** while **"Identifying the threat of fire early was effective in order to inform the fire service and respond quickly."** obtained the lowest rating of **3.72**, which is interpreted as **"Very**

Satisfactory." This means that the respondents are agreeing that early detection is effective in fire emergency.

Table 2.
Respondent’s Assessments for Fire Alarm

Indicators	Fire Department Personnel		Barangay Personnel		IT Practitioner		Average	
	W.M	Interpret	W.M	Interpret	W. M	Interpret	W. M	Interpret
Fire alarms are effective for alerting you through loud sirens.	3.48	Satisfactory	3.64	Very Satisfactory	3.83	Very Satisfactory	3.65	Very Satisfactory
Fire alarms are effective at giving you sufficient time to leave the area where you are.evacuation.	3.64	Very Satisfactory	3.72	Very Satisfactory	3.75	Very Satisfactory	3.53	Very Satisfactory
Fire alarms are more effective when they are used in areas where fire can easily spread.	3.68	Very Satisfactory	3.76	Very Satisfactory	3.83	Very Satisfactory	3.76	Very Satisfactory
Using fire alarms is an effective way of saving both lives and property.	3.68	Very Satisfactory	3.68	Very Satisfactory	3.83	Very Satisfactory	3.73	Very Satisfactory
Fire alarms are effective for improving the response time of firemen.	3.68	Very Satisfactory	3.60	Very Satisfactory	3.83	Very Satisfactory	3.70	Very Satisfactory
Overall Weighted Mean	3.63	Very Satisfactory	3.68	Very Satisfactory	3.81	Very Satisfactory	3.67	Very Satisfactory

Table 3. shows that the overall over-weighted mean of the indicators has a rating of **3.67**, which is interpreted as **"Very Satisfactory."** It also shows that both fire department personnel, barangay personnel, and IT practitioners answered the questions with "Strongly Agree." It can be seen that the fire IT practitioner garnered a higher rate of **3.81** compared to the fire department and barangay, who only obtained 3.63 and 3.68. It is also shown that the question **"Fire alarms are more effective when they are used in areas where fire can easily spread."** garnered the highest rating of **3.76**, which is interpreted as **"Very Satisfactory,"** while **"Fire alarms are effective at giving you sufficient time to leave the area where you are.evacuation."** obtained the lowest rating of **3.53**, which is interpreted as **"Very Satisfactory."** This means that the respondents are agreeing that having a fire alarm is effective in a fire emergency.

2. Evaluation of the respondents on the proposed study, Centralized Fire Locator System through IOT-Based Fire Alarm System using the criteria based on ISO 25010.

Table 3
Evaluation of the Respondents using ISO/IEC 25010 on the Centralized Fire Locator System through IOT-Based Fire Alarm System In Selected Barangays in Taguig City in Terms of Functional Suitability, Performance Efficiency, Usability, Portability and Maintainability

Indicators	Fire Department Personnel		Barangay Personnel		IT Practitioner		Average	
	W. M	Interpret	W.M	Interpret	W. M	Interpret	W. M	Interpret
1.Functional Suitability	3.76	Very Satisfactory	4.55	Excellent	4.64	Excellent	4.31	Very Satisfactory
2.Performance Efficiency	3.61	Very Satisfactory	4.56	Excellent	4.58	Excellent	4.25	Very Satisfactory
3. Usability	3.38	Very Satisfactory	4.54	Excellent	4.58	Excellent	4.17	Very Satisfactory
4. Portability	3.38	Very Satisfactory	4.46	Very Satisfactory	4.47	Very Satisfactory	4.10	Very Satisfactory
5.Maintainability	3.53	Very Satisfactory	4.44	Very Satisfactory	4.75	Excellent	4.24	Very Satisfactory
Overall Weighted Mean	3.53	Very Satisfactory	4.51	Excellent	4.60	Excellent	4.21	Very Satisfactory

Table 3 shows the summary total of the evaluation of the project using the ISO/IEC 25010 quality standard. The table shows that the total result in terms of functional suitability of the system was 4.31, interpreted as "very satisfactory" by the participants. It means that the system's functions meet the requirements, but that it still needs to be improved. And in terms of performance efficiency, the total result is 4.25, which is interpreted as "very satisfactory." It indicates that the performance of the system meets the requirements, but that it still requires improvement. In terms of the usability of the project, the total result was 4.17, and they interpreted it as "very satisfactory." It indicates that the usability of the developed project satisfies the criteria, but that it may yet be developed. And with regard to the portability of the project, the total result is 4.10, interpreted as "very satisfactory." It shows that the developed project's portability meets its requirements, but that it may have been improved for more adaptability. Lastly, with a total score of 4.24, the participants rated the project in terms of its maintainability as "very satisfactory." It means that the developed project meets or surpasses its goals, but it still has to be improved.

3. What are the enhancements suggested by the fire department personnel, barangay personnel, and IT practitioners on the Centralized Fire Locator System through IOT Based Fire Alarm System In Selected Barangays in Taguig City.

The following are the choices made as suggested enhancements, namely: graphical user interface, hardware, and developing an Android version of the system. Statistics show that most of the respondents suggested adding more features to the website application, providing hardware where you can show the process of detection, and lastly, developing a monitoring app for the homeowner.

V. CONCLUSION AND FURTHER RESEARCH

The following conclusions were found as a result of the above major discoveries:

1. The overall evaluation of the fire department personnel, barangay personnel, and IT practitioners of the proposed IOT-based fire alarm in Taguig City was interpreted as "Strongly Agree."
2. The respondents interpreted the effectiveness of early detection in a fire emergency as strongly agreeing.
3. The IT practitioners' evaluation of the system's suitability was interpreted as excellent.
4. The evaluation of the respondents to the performance efficiency of the system was interpreted as "Very Satisfactory"
5. There were enhancements suggested by the respondents for the improvement of the Centralized Fire Locator Systems through IOT Based Fire Alarm System in Selected Barangays in Taguig City.

In the light of the conclusions made in this study, the researchers recommend the following:

1. The researcher recommends that instead of using a power bank as a backup power source, use a solar panel or a power supply like UPS, or the Uninterruptible Power Supply, to replace the power source when a brownout occurs during a fire emergency.
2. The researcher recommends providing a fire alarm that is directly connected to a speaker to assist in making it louder and alert other people in the neighborhood.
3. The researcher suggested that if they provide resources such as hardware and software for each residence in a selected barangay in Taguig City, they must ensure that it is simple to access and utilize.
4. The researcher suggested providing the materials with which to install it and ensuring that the sensor functions well and that it is recognized.
5. The researcher suggested that they have to improve the system and create a tracking application that allows the user to keep track of their home's status and temperature.

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