

Solar-Powered Fire Extinguisher With Integrated Fire Alarm

Mrs. Sushma H S¹, Nisarga M², Nithya H G³, Rageshwari R S⁴, Sanjana M⁵

Assistant Professor, Department of EEE, GSSSIETW, Mysuru, India¹

Student, Department of EEE, GSSSIETW, Mysuru, India²⁻⁵

Abstract - Growing inclination toward sustainable and effective fire suppression technologies subsequently drives the market for new technologies. AbstractThis project paper discusses the design and construction of a solar powered fire alarm cum extinguisher. Their system would use solar power, allowing for a constant source of power without greenhouse gas emissions that help drive climate change in the way batteries used to power conventional fire extinguishers do. The next solar-powered fire extinguisher will have been equipped with high-grade sensors and AI algorithms for the real-time tracking and analysis of burning incidents. Not only does the integrated fire alarm system immediately trigger extinguishing action, but it also alerts those on-site as well as emergency response services. This networked approach improves the overall efficiency of fire suppression systems and makes an intelligent and robust solution for both domestic and non- domestic areas Similarly, the aim of the project is to find out if this kind of a solar powered fire extinguisher can be cost-effective, reliable and adapt itself to different locations. This project advances the mission of developing sustainable and effective solutions for fire prevention systems, emergency response, while also utilizing alternative energy sources

Keywords: Solar Energy, Renewable Energy, Fire Extinguisher, Fire Alarm.

I. INTRODUCTION

Solar energy is a sustainable and renewable power source that is derived from the sun's radiation. It is harnessed using the various technologies such as solar panels, photovoltaic cells, and solar thermal systems. With its huge availability and environmentally friendly nature, solar energy plays an important role in mitigating climate change and it also helps in reducing reliance on fossil fuels. From powering homes and businesses to fueling spacecraft and remote locations, solar energy offers a versatile solution for meeting energy needs around the world.

Solar energy is a renewable energy source applicable to a great number of uses. It generates electricity at home, in business, and in communities for use either residentially or commercially. Solar energy is also used in outdoor lighting, powering small devices, and even agricultural equipment like irrigation systems. Its ability to produce clean, renewable energy makes it an alternative to reduce reliance on fossil fuel and combat climate change. In summary, solar energy has a wide variety of applications that would help people and the environment in general.

It is applicable to fire alarm systems because it provides energy in a very reliable and environmentally-friendly manner. By installing solar panels into the fire alarm system, buildings are able to maintain constant power to important safety equipment during a power outage or other emergencies. This would ensure that the system for fire detection and notification works in such a manner that the whole safety and protection of the building can be improved. Additionally, solar-powered fire alarms reduce dependence on grid electricity, making them applicable to remote or off-grid locations where traditional power sources are absent or sometimes unreliable. This combination of reliability, sustainability, and independence makes solar energy an excellent choice for fire alarm systems.

The Solar-Powered Fire Extinguisher with Integrated Fire Alarm System is a ground-breaking project aimed at revolutionizing technology in fire safety through harnessing the power of solar energy.

The innovative system integrates the functionality of a conventional fire extinguisher with the state-of-the-art fire alarm system, all run on renewable solar energy. This project has combined these two crucial elements with the goal of increasing the efficiency and efficacy of fire prevention and response measures in both residential and commercial settings. This report will provide a detailed overview of the design, development, and implementation of this ground breaking project, highlighting its potential impact on improving fire safety standards and promoting sustainability in the field of emergency preparedness.

**II. RELATED WORK**

A Solar-Powered Fire Extinguisher with Integrated Fire Alarm System requires a comprehensive review of the existing research, studies, and technologies that exist in the area of solar-powered fire safety systems and integrated fire alarm systems.

Previous research has underlined the great potential of solar energy in powering a variety of devices and systems, including fire safety equipment. Research into integrated fire alarm systems has shown early detection and quick response to be very important in the minimization of fire damage and for occupant safety.

This literature survey will synthesize information from these sources and help identify the gaps in current knowledge and will guide the design and development of an innovative solution fusing solar power with fire safety technology for increased emergency preparedness and sustainability.

This literature review identifies the challenges that firefighters face in high-risk environments and presents an impulsive fire extinguisher robot designed by Yash Yadav, Harshit Gupta, Sandeep Kumar Verma, and Ms. Farah Naz.

This robot, which is compact in design, is fitted with a GSM module for alerts, ultrasonic and IR fire sensors, and solar-powered charging, which can help fire fighting capabilities in restricted areas and the risks that firefighters take. Advancements in Solar Energy for Remote Application.

- Shashi Gandhar, Kirti Sharma, Nakul Verma, Divyam Goel, and Yuvraj Shubham present a solar-powered, real-time fire detection system. The system, with flame, temperature/humidity, and smoke sensors, shows benefits over traditional smoke sensor-based alarms. Its Wi-Fi connectivity makes the information transmit correctly to help the authorities take decisions regarding the fire prevention and extinguishing process. Economic Feasibility and Cost-Benefit Analysis.

- Gundekar, Wadkar, Mahind, and Prof. S.R. Kale present an IoT-based "Fire Detection and Extinguisher System" for effective home automation. The system, developed using Arduino, fire and gas sensors, and a GSM module, identifies and alerts during a fire outbreak well in time and sends an SMS or call for action to take measures immediately. Besides, the system sends the water sprayer into action to try and extinguish the fire.

III. BENEFITS AND CHALLENGES**A. Benefits:**

- Environmentally Friendly.
- Minimal Cost.
- Remote accessibility.
- Integration of system.
- Completely green

B. Challenges:

- High initial investment.
- Weather dependency.
- Maintenance Challenges

IV. METHODOLOGY

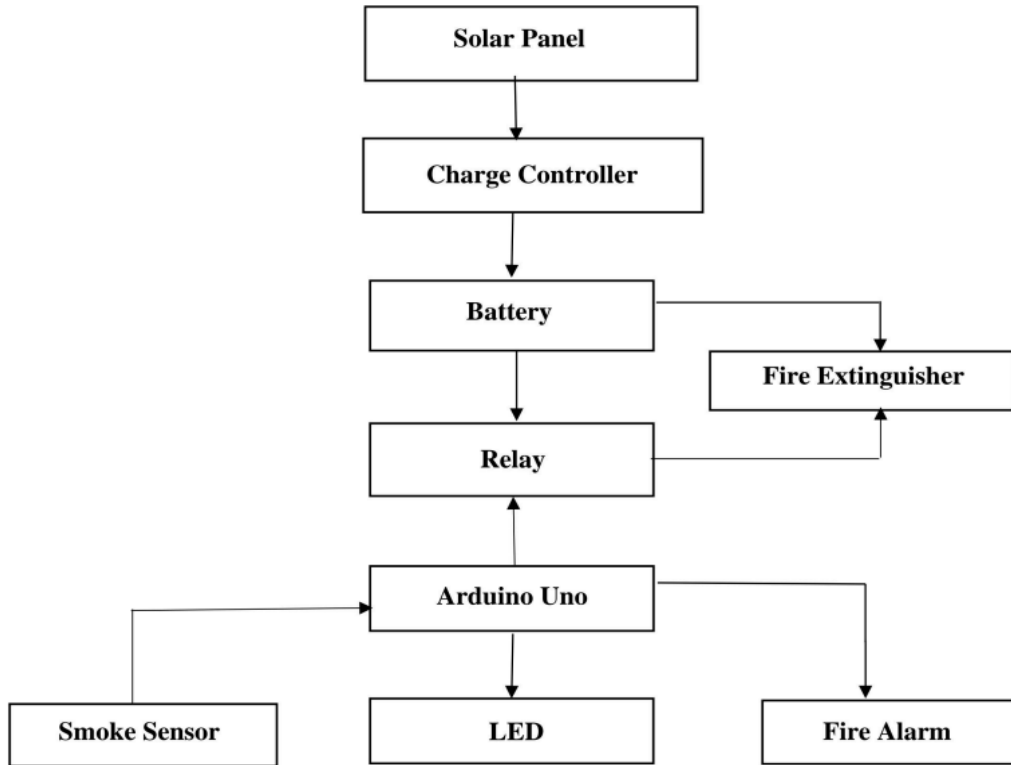


Fig.1

Our prototype is built in such a way that the emergency fire controller detects and extinguish the fire. The smoke detector used senses the smoke when the temperature is above 135°F(57°C). Initially, the LED used will be green. When the smoke detector senses the smoke, the red LED will glow and the alarm beeps, i.e., the buzzer produces the sound in our prototype. As soon as the alarm beeps, the buzzer triggers the fan. These connections are mainly made using an Arduino board and relay module. And the source for this is provided using solar energy that is stored in the li-ion battery.

V. MATERIALS NEEDED

c. Hardware description:

Sl.No	Hardware	Quantity
1	Solar panel	2
2	DC Motor	1
3	Relay module	1
4	Smoke sensor	1
5	Buzzer	1
6	LEDs (Light Emitting Diode)	1

Table.1

Software description:

SLNO	Software
1	Arduino Software

Table.2

VI. RESULTS AND DISCUSSION

A. The integration of fire alarm and extinguisher systems has huge results in enhancing fire safety measures within buildings. It has been observed that this integrated system helps to reduce time response to fire incidents.

Temperature (in F)	Smoke Sensor	Buzzer	LED	Extinguisher
50	Not Detected	OFF	GREEN	OFF
200	Not Detected	OFF	GREEN	OFF
350	Not Detected	OFF	GREEN	OFF
351	Detected	ON	ON	
355	Detected	ON	RED	ON

Table.3

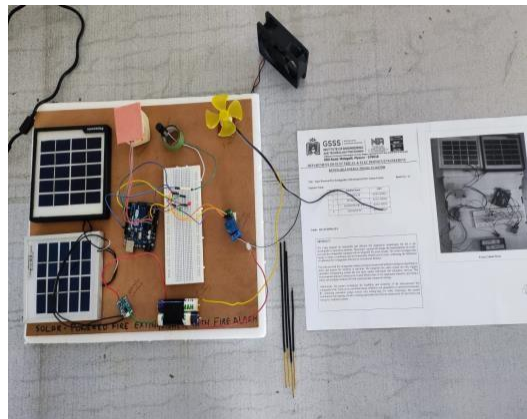


Fig.1

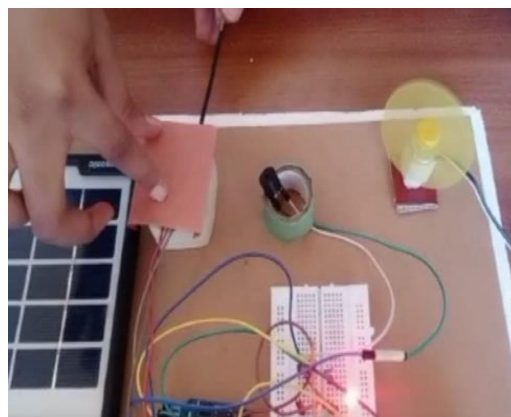


Fig.2

VII. CONCLUSIONS

Based on the results achieved from integrated fire alarm and extinguisher systems therefore give this method a high rating as effective in enhancing fire safety measures. The integration between alarm systems, which inform occupants of any impending risk, and extinguisher systems that facilitate fast fire extinguishing, has proven to be a very successful strategy against fire hazards. Data from case studies and practical application consistently show the integrated system's huge contribution to overall building safety. The systems offer not only building protection but also a priority for the safety of lives and care for the well-being of the occupants inside, thus giving a total response to fire cases.

Early detection through fire alarms and instant suppression through extinguisher systems make the building better able to deal with fire emergencies. Such quick response would not only support the easy evacuation of occupants but also help curtail fires before they grow further, thus serving to save a lot of property damage or human life.

VIII. FUTURE SCOPE

- The system brings advancements in integrated fire safety systems.
- The continuous research in the following area will explore AI and IOT.
- The update to integration system into smart buildings and fire safety places.

IX. ACKNOWLEDGEMENT

We would like to express our sincere gratitude to **Mrs. Sushma H S**, Assistant professor. For their valuable guidance and support throughout this Renewable energy project. We also extend our thanks to **Dr. Sreeramulu Mahesh** Head of the Department for their insightful feedback and suggestions. This work was made possible by the generous support of GSSSIETW, Mysore. Providing access to Renewable energy lab. Finally, we are grateful to our families and friends for their encouragement and understanding.

REFERENCES

- [1] Impulsive Fire Extinguisher with Solar Power Yash Yadav¹, Harshit Gupta², Sandeep Kumar Verma³, Ms.FarahNaz⁴
2nd International Conference on "Advancement in Electronics & Communication Engineering (AECE 2022) July 14-15, 2022 Institute of Technology, Ghaziabad, India.
- [2]. Yadav, Rishika and Rani, Poonam, "Sensor Based Smart Fire Detection and Fire Alarm System," Proceedings of the International Conference on advances in Chemical Engineering (AdChE) 2020
- [3]. Kyung Chang Lee and Hong-Hee Lee, "Network-based fire-detection system via controller area network for smart home automation," in IEEE Transactions on Consumer Electronics, vol.50, no.4, pp.1093-1100, Nov.2004 doi: <https://doi.org/10.1109/TCE.2004.1362504>
- [4]. An automatic fire searching and suppression system for large spaces, Tao Chen, Published 1 June 2004 Engineering Environmental Science, Computer Science, Fire Safety Journal
- [5]. Design and Implementation of an Automatic Forest Fire Extinguisher Using Sprinklers A. Rajendra, F. Mariam, +1 author G. Hannah Priya, Published in Indian Journal of Science and technology 20 December 2019
- [6]. Journal of Information and Optimization Sciences Volume 43, 2022 - Issue 1: Novel Amalgamation of Sustainability and Innovation A real-time solar powered fire detection system, Shashi Gandhar, Kirti Sharma, Nakul Verma, Divyam Goel & Yuvraj Shubham