IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

A SMART ROBOT FOR INSPECTION IN DISASTER AREAS

K.Varalakshmi [1]

V. Dharma Prakash [2] A.Vijayanarayanan[3] B.Priya [4] S.S.Vasantha Raja [5]

Assistant Professor[1,2,3,4,5]

Department of Computer Science and Engineering

PERI INSTITUTE OF TECHNOLOGY

Abstract

Robots can play an important role in recovery operations that present considerable dangers for human rescue teams, such as after chemical explosion and fire explosion. However, the robots currently used are limitedin their ability to interact and cooperate with humans byusing three sensors. This paper introduces a framework for the rescue robot development and control. Humans can be used for rescuing people in these areas, but due tohigh risk of building collapses it is not possible to send human rescue teams in these areas. Thus affordable high technology equipment which makes this risky job quicker and safer is needed for the hour, which has beendescribed in this paper.

Keywords-

Arduino Uno Microcontroller, Zigbee, Temperature sensor, gas sensor, MEMS sensor,buzzer, Robot mechanism, ESP32 Modulo (Board).

INTRODUCTION

Disaster in areas that are caused by negligence, accident or lack of maintenance are sudden and unexpected damage occurs. For the last few decades, many disaster has happened, such as chemical explosion, gas leaking has caused huge economic losses and human life loss. Of increasing worldwide population in high hazard and vulnerability areas became the main factor. The aim of the smart robot is to track the actions, gathering information from disaster area and other concepts of monitoring that are necessary. The smart robot has now been used to target identification and recognition where it focuses mainly on the protection and gathering information about temperature, gas leaking in disaster area along with rescue team.

This idea of the smart robot could be combined with the avoidance obstacle robot, which allows the mobile robot to travel automatically and track the obstacle-free area because of three sensors which is based on wireless network.

The Arduino is a microcontroller electronic system. It is commonly using for a project purpose as it is easy to handle either hardware or software. There are many sensors that can be integrated with Arduino such as ultrasonic, temperature, gas sensor. Because of accessible and versatile to customize for the software and hardware, Arduino was commonly used compared to other controllers, provided several types of boards and sensors that enable caries project to be implemented, user- friendly where it only required USB to communicate with the PC and affordable cost. The team of rescue members can wirelessly receive the data in real time and perform their job accordingly. By the help of this robot rescue team can get information that the area is safe or not before entering to that particular location. The robot is equipped with LPG gas module, Temperature and memory sensor. It has a live camera that is equipped with communication Camera provides live streaming without any delay over wireless link at 2.4 GHz ISM band.

EXISTING MODEL

Disaster management is done through disaster areas to obtain immediate chemical explosion information for reducing damage. It may be enough to obtain the general condition of the earthquakeover an area, but too small to collect information with fine granularity such as data on each building for effective rescue operation or damage control. There are several preceding researchers whose objectives are close to ours propose an earthquake information system using laptop PCs which equip accelerometers. Some other research groups use mobile smart devices.

Here, It is based on IOT. So it works only on internet. In existing, it will not work on certainareas because of internet issue. Without internet, it unable to work.

1. Fire sensor

The project fire alarm or fire detector using Flamesensor. The sensor basically detects IR (Infra-Red) light wavelength between 760 nm – 1100 nm (nanometer) that is emitted from the fire flame.

2. Gas Sensor

Gas sensor is used for detecting smoke and some flammable gases like LPG, Methane, etc. Itchanges its resistance depending on the type of the gas. This can be usedto raise an alarm based on the concentration of the gas.

3. Metal Gear Servo Motor

The servo motor is not a specific type of motor but rather a combination of a DC motor coupledwith a control unit and encoder.

PROPOSED MODEL

This system consists of two parts. One is the central database server that collects and stores information from distributed sensor terminals. The other one is a sensor network which is formed by numerous sensor probes that are placed in buildings. The sensor probe consists of a gas sensor, temperature sensor and MEMS to gather the required parameters. The MEMS is used to find seismic action, the gassensor to find any leakage of harmful or flammable gas, and the temperature sensor to find the temperature around the probe. The system forms a wireless network to transfer information from each probe up to the central server. We employed Zig-Bee wireless technology for this network as mentioned in the previous section.

MEMS sensor

MEMS full form is Micro Electro-Mechanical System. It is a chip-based technology wheresensors are composed of a suspended mass between a pair of capacitive plates.

Temperature Sensor

The temperature sensor in Arduino converts thesurrounding temperature to voltage.

Gas Sensor

Gas sensor is used for detecting smoke and some flammable gases like LPG, Methane, etc. It changes its resistance depending on the type of the gas. This can be used to raise an alarm based on the concentration of the gas.

Zigbee

Zigbee is a wireless communication protocol targeted for battery powered devices .it has bothlow power and low cost.It generally operates in the 2.4GHz range.

ESP32 Modulo

ESP32 is a microcontroller developed by Expressive Systems which has builtin Wifi and dualmode Bluetooth support.

SYSTEM IMPLEMENTATION

The system was developed with a robotic setup with three sensors which can move to the disaster locations. This technology can help find and rescue people when time is of the essence, as well as explore remote parts of the globe, collecting information and data for researchers.

1. Using temperature sensor, it finds the surrounding temperature which helps us to find the temperature of the place. Temperature Sensors measure the amount of heat energy or even coldness that is generated by an object or system.
2. Using gas sensor that can detect the presence and concentration of specific gases such as carbon dioxide, carbon- monoxide, oxygen, and ammonia.

3. Using MEMS sensor Micro-Electro-Mechanical System is used to find the strong motion that is deducted by histories of acceleration.

All these three sensor are collected the information to the data microcontroller as we already know it is used to communicate to other devices such as PC, and Mobile. Here the data microcontroller we used is Zig-bee. Zig-bee is an IEEE 802.15.4 - based specification for a suite of high-level communication protocols. After collecting data, we transmit the data to find the exact result and minimize the risk of rescue teams.

SYSTEM ARCHITECTURE

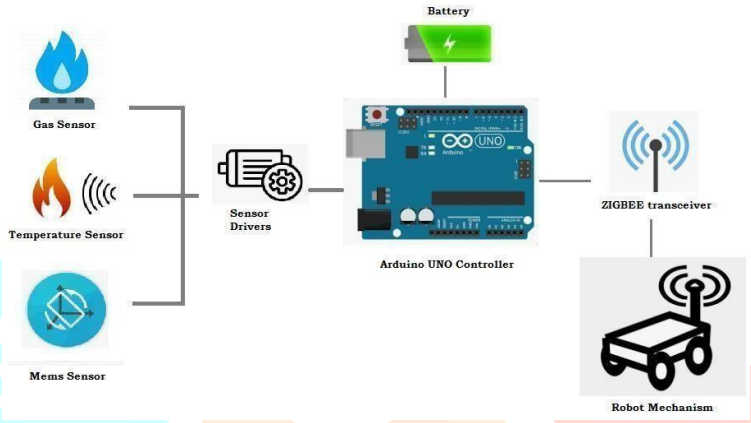

Fig 1: overview

EXPECTED OUTCOMES

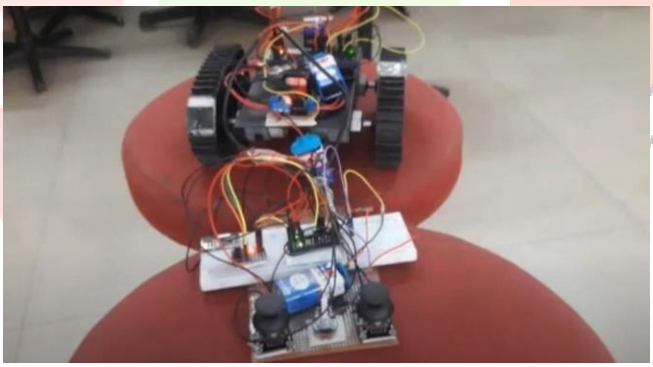

Fig 2: outcome

LITERATURE SURVEY

H.M. Salam et al. (2021) to assess the outcomes and effectiveness of the system, the recommended approach are being put to the check in a supervised setting. In order to inspect and authenticate the survival strategies recognition rate including instantaneous data broadcast rate on the interaction-pumping ground station in addition to the portable devices, the device was constructed and contributed in many locations among multiple barriers. The outcomes of breathing, motion, and heart rate during surviving on any type of catastrophe zone are also included in the foregoing paper.[1]

Lin CY et al. (2014) proposed a technology for monitoring and warning of calamities are commonly utilized to alert people to situations of emergency. The current alert systems, particularly for natural calamities like earthquakes, are unableto work in tandem with domestic devices as well as integrated control devices, which mean the systems are unable to offer sufficient notice for preparation and an escape. Whenever an earthquake occurred, physical evaluation was done to gauge ADRS's efficiency. According to our findings, ADRS may perform urgent jobs faster than traditional methods of doing so by up to 15 seconds. These tasks are performed by giving persons sufficient opportunity to hide beneath strong objectsof furniture, go from the third level to the first floor, or dash over one hundred meters.[2]

Boukerche et al. (2018) through strengthening catastrophe identification and rescue efforts at the time of the aftermath of a disaster, this study suggested ways to proceed with catastrophes and emergency situations. As a result, Internet of Things (IoT) gadgets are utilized to gather information, assist in finding people wounded after disasters, and recognize threats. A alerting and responding solution that is entirely IoT-based, will probably not be completely adequate for crisis management in modern cities because Internet of Things (IoT) device problems with connection could arise because of network overload or structural failure.[3]

A. F. Aliek et al. (2021) an unavoidable, abrupt natural occurrence is referred to as a natural disaster. Both property loss and fatalities may be caused by natural catastrophes. With the help of this research, a working device that can locate casualties of catastrophic events as well as identify their presence will be created. Thermal sensors are employed as metrics by the working version of this gadget for observing the casualty. By measuring the body’s internal temperature, the device concentrates on identifying suitable individuals. Additionally, the receiver for GPS is provided with thisgadget. The Naive Bayes method is utilized in the design of this technology's model. The Naive Bayes approach is implemented to figure out the conclusion effect. By using the LoRa networking protocol, the ground unit can get the location of the attacker data from the device used for GPS tracking.[4]

K. K. Yadavalli et al. (2022) the author developed a IoT enabled framework on disaster management. The systemcomprised of hybrid virtual platform with numerous dynamicsensors is connected. The sensor modules collects data and off-shelf the values for mitigation of disaster areas. An

autonomous framework is implemented with wireless nodes connected through the robotic system. The complex architecture degrades the performance of the robot operation.[5]

CONCLUSION

The science of sensors and the development of embedded computer systems have led to numerous advancements. A novel sensing network framework for disaster data collection and analysis, including information on the actual environment and possible messages from survivors, is the subject of this study. The overall structure is comprised of a large number of sensor devices and a centralized informationserver. The internal ZigBee system that is coordinated by thesensor devices is overseen by the main database server. The server must be connected to the internet in order to provide global access to comprehensive data on catastrophic events. The framework contained an automated configuration that is able to travel to disaster sites and evaluate the viability of anindividual's involvement.

FUTURE ENHANCEMENT

We are planning on upgrading the robot with more unique and advanced features to ensure the highest safety of our livesand properties. This robot can be further upgraded by using various sensors, cameras, and other devices. We are focusing on making this robot by using image segmentation to classifythe objects in front of it. Furthermore, we will work on making this robot an Unmanned Ground Vehicle (UGV) for defense purposes. Due to advancements in technologies, AI has become more famous in robotic systems. Several AI sensing modalities can be used to upgrade the system for working autonomously.

REFERENCES

1. Localization", in IEEE TRANSACTIONS ON INDUSTRIAL INFORMATICS, VOL. 12, NO. 2, APRIL [2016]
2. Petros Spachos, Liang Song, Dimitrios Hatzinakos "GAS LEAK DETECTION AND LOCALIZATION SYSTEM THROUGH WIRELESS SENSOR NETWORKS", in IEEE Xplore DOI: 10.1109/CCNC.2014.6940506.[2014]
3. Salman Ali, Adnan Ashraf, Saad Bin Qaisar "A WIRELESS SENSOR NETWORK MONITORING PLATFORM FOR OIL AND GAS PIPELINES", in IEEE Systems Journal, DOI: 10.1109/JSYST.2016.2597171.[2018]
4. Shinian Wang, Yi Chai, Zhimin Yang"GAS SOURCE LOCALIZATION BASED ON MAXIMUM LIKELIHOOD WITH ARBITRARY DEPLOYMENT WSN", in IEEE Xplore DOI: 10.1109/ChiCC.2014.6896647.[2013]
5. Guijie Wang, A. Heidary "SMART TEMPERATURE SENSOR", in IEEE Journal, DOI:10.1016/B978-0-08-102055- 5.00003-6[2018] Fabian Chraim, Yusuf Bufra Erol, and Kris

Pister "Wireless gas leakage detection and Junru Lin, Baohui Zhu, Peng Zeng, Wei Liang "MONITORING POWER TRANSMISSION LINES USING A WIRELESS

SENSOR NETWORK", in IEEE Xplorehttps://doi.org/10.1002/wcm.2458 [2018] RupingLiu, Liang He, Marijuana Cao "FLEXIBLE TEMPERATURE SENSORS",in IEEE Systems Journals, DOI:10.1021/acsami.6b1456[2015]

6. Zhou Y.M, Yang X.L "WIRELESS SENSOR NETWORK", in IEEE Systems Journal, DOI: 10.4236/cn.2009.12015 [2021]
7. Wang and Roach "GAS LEAKAGE MONITORING USING MOBILE NETWORK" in IEEE Systems Journal, DOI:10.1088/1742-596/1717/1/012068 LicenseCC BY 3.0 JUNE[2022]
8. H.M. Salam, Daniel Cobos Munoz "A systems approach to assessing complexity in interventions: an effectiveness decay model for integrated community case management" in IEEE System Journal, doi: 0.1080/16549716.2020.1794106 [2020]
9. H.M. Salam, Daniel Cobos Munoz "A systems approach to assessing complexity in interventions: an effectiveness decay model for integrated community case management" in IEEE System Journal, doi: 10.1080/16549716.2020.1794106 [2020]
10. A. F. Aliek et al, Nikunj Makwana "Disaster management" in IEEE Journal Systems, doi: 10.4103/jumps.jfmpc_893_19 [2021]
11. Lin CY, jane W S, "Active Disaster Response System for a Smart Building", in IEEE Journal systems, https://doi.org/10.3390/s140917451[2014]
12. Cheikhrouhou, K. K. Yadavalli "A Disaster Management Framework Using Internet of Things-Based Interconnected Devices", in IEEE Xplore https://doi.org/10.1155/2021/9916440 [2022]