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An Autonomous System of Mobile Robots for Search in Disaster Affected Sites

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ABSTRACT: This initiative addresses the issue of catastrophe robot accidents, which kill many individuals each year. It has been discovered that the number of deaths in the disaster robot sector is roughly six times greater than in all private industries. The majority of these catastrophes are the result of poisonous gases, fires, and a lack of a recovery mechanism. This degree of mortality may be significantly decreased by introducing a disaster Monitoring robot that can roam about unattended in the mines and identify the variety of poisonous gases and ambient temperature and communicate them continuously to the control centre. The goal of this project is to complete this assignment. From a technological standpoint, this project is focused on hardware as well as software. It necessitates highly particular sorts of sensors as well as novel data transmission and reception mechanisms. So a traditional strategy will be ineffective from an industrial standpoint. The project is regarded genuine if it can detect various types of gases, temperature, and provide a warning to miners inside the mine in the event of a risk while simultaneously communicating all information to the supervisor's panel. The data sent to the control panel may make a big impact, and setting up and offering rescue methods to a crew can enhance the retrieval much more practical.

I. INTRODUCTION

The use of robots to assist rescue people in mine rescue operations is a current subject of study. We want to build a robot and transport it into the mine with details about the environment within the mine to look for victims. A coal mine is a perilous area with numerous lethal circumstances that endanger human existence, especially when explosions occur. Under such conditions, rescue personnel frequently have no idea what is going on in the mine tube. As a result, going into mine tunnels to look for survival without first analyzing information about the environment might be extremely risky. To address this issue, a coal mine detection and retrieve robot can be designed to aid rescue workers. The coal mine detect and rescue robot is used to identify the explosive surroundings of a mine site and to retrieve miners trapped below following a huge explosion. We will create a prototype of a completely autonomous robot that can be used to detect the presence of hazardous gases inside a mine for mine rescue operations in the event of an emergency resulting from a natural disaster such as an explosion. An autonomous vehicle is a mining sites rescue robot. It can monitor gas concentration in an explosive situation. This study proposes the development of a coal mine detection and rescuing robot. It contains numerous characters that are appropriate for a mining tunnel. It is made up of mechanical, electrical, computer, control, communication, sensor, and other components. Mechanical, electrical, and programming design are the three key components of the robot's construction. The architecture of an embedded control system based on a microprocessor is given in this study. Several duties of the robot can be accomplished by the integrated control system, including mobility control, environmental information gathering, interaction with the control system via the internet, and the execution of sophisticated control techniques.

II. LITERATURE SURVEY

The research offers four coordinated robot search and rescue options based on the Internet of Things and artificial intelligence. Robots that are on the ground, the surface, the air, and the water gather "sensory data" from the relevant surroundings and transfer it to nearby computers for further cloud services (training, validation). Skilled AI models are first evaluated on the on-site workstation through the cloud, and then disseminated to the embedded system in robots for ongoing learning. The results demonstrate that the interaction of the robots is more successful than that of



a single robot. The results also demonstrate that artificial intelligence-based decision-making appears to be better suitable for the context of disaster response. The goal of the research described in this paper is to expand the capabilities of a single robot in a crisis intervention setting. The results show that several robots do jobs more efficiently than a single robot. The findings also demonstrate that adopting artificial intelligence for decision-making is more suitable in a search and rescue environment.

III. HARDWARE IMPLEMENTATION

A. POWER SUPPLY

The power source may be seen as an electrical machine that drives power requirements. This device's primary job is to convert electrical current from the source into the appropriate voltage, frequency, and current needed to power the load. These power sources are also referred to as electric power converters. Others are standalone loads, while other supplies are integrated within the machines they operate.

B. ATMEGA8 MICROCONTROLLER

The ATmega8, an 8-bit CMOS microcontroller with low power consumption, is built on the AVR RISC architecture. In order to achieve optimum efficiency near to 1 MIPS per MHz, the ATmega8 executes strong instructions in a single phase of the clock. This enables the design expert to balance power use and processing efficiency.

C. LIQUID CRYSTAL DISPLAY

A liquid-crystal display is a straightforward monitor and possibly other optical instrument that is digital format controlled and makes use of the light-modulating characteristics of liquid crystals (LCD). Liquid crystals don't immediately produce light; instead, they use a backlight or reflector to create coloured or monochromatic images. LCDs can show image data with little information that can be perceived or concealed, such as pre-programmed text, digits, and 7-segment displays, or random graphics (much like a desktop screen in the broad sense as in a digital clock). With the exception of some displays having bigger components and some displays having random visuals made up of several small pixels, they both make use of the same technology involved. A few of the various applications for LCDs include computer monitors, TVs, instrument panels, cockpit displays in aeroplanes, and indoor and outdoor signage.

D. IOT – ESP3266

The Internet of Things enables things to be identified or accessed remotely through current network infrastructure, enabling a more seamless integration of the natural environment into computer-based processes. This reduces the need for human intervention while increasing efficiency, accuracy, and economic value. When IoT is strengthened with sensors and actuators, it becomes a subsection of the wider class of cyber-physical systems, which also offers interlinked grids, virtualized power plants, smart homes, and smart buildings. Even if the embedded computing system in each object can identify it uniquely, it may still be able to connect with the existing internet infrastructure.

E. GAS SENSOR

Based on optical sensors, the kind of gas to be detected, physical characteristics, and a number of other factors, gas sensors come in a wide range of characteristics. This insight examines a methane gas detector that can identify gases that methane can produce, such as ammonia. The detection element of this sensor adsorbs the gas once it is ionised when it comes into proximity to the sensor. The element develops an electrical potential as a result of this adsorption, and this electrical potential is transmitted via the output ports as electrical current to the processing unit.

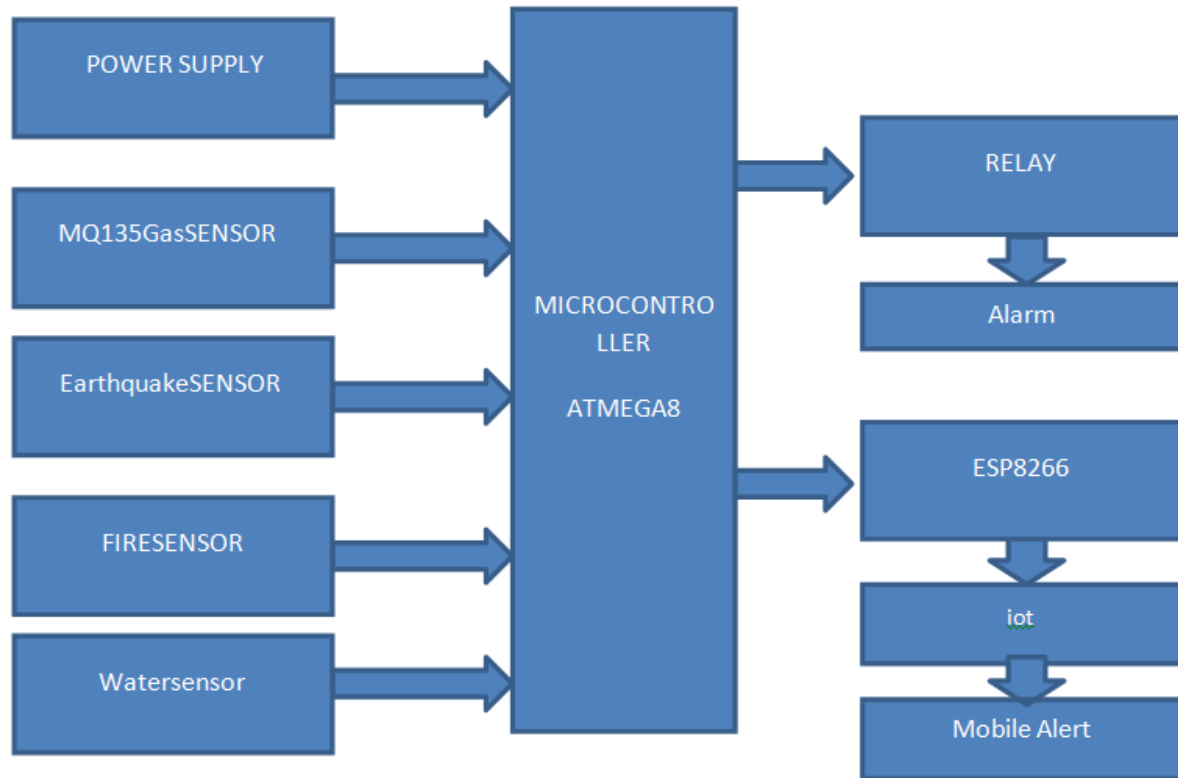


Fig 1:Block diagram of the disaster rescue robot

F.VIBRATION SENSOR

This generally open vibration sensing element is used for a number of vibration trigger functions, such as reporting theft alarms, smart cars, and electronic building blocks. Please keep in mind that an usually open vibration sensor modules induction of a tiny vibration whenever the trigger time is extremely short, insufficient to drive the relay, a few of the information display can be linked directly to the relay module, the actual usage of effective.

G.DC MOTOR

Direct current (DC) series motors transform electrical energy into mechanical energy. Its functioning is based on a basic electromagnetic principle, which states that rotational motion happens when an external field interacts with a magnetic field formed around current-carrying conductors. The armature (rotor), stator, commutator, field windings, axle, and brushes are the main components of a DC series motor. The stator, which is a permanent part of the motor, is made up of two or more electromagnet pole components. The rotor is made up of the armature and the core field winding that join it to the commutator. The armature windings are linked to the output power supply through a brush arrangement coupled to the commutator. A central axle is circled by the rotor.

H.FIRE SENSOR

A specific type of sensor called a flame-sensor is made to detect and respond to the flames that are present or fire. The responsiveness to smoke detection may be impacted by its fitting. It has a natural gas hookup, a propane tank, an alarm, and a firefighting system. This sensor is widely used with industrial boilers. The boiler's correct operation is the fundamental objective of this. Due to the method used to track the flame, these sensors react more quickly and precisely than a heat/smoke sensor.



I.WATER SENSOR

The water sensor brick is made for water identification and may be used to track liquid leaks, rainfall, and water levels. One of the best ways to find leaks, spills, floods, or rain is by installing a water sensor to an Arduino. It can determine whether there is water by sensing its level, volume, and/or absence. While a better Grove sensor is offered for that function, this might be used to remind you to water your plants. An array of exposed traces on the sensor reads LOW when water is detected.

J.ALARM

The detection of unauthorised entrance into a building or other services, such a house or school, is done by a burglar alarm. Home, corporate, industrial, and military security alarms guard against theft, property damage, and personal safety from intruders. A decline in robberies has been linked to neighbourhood security warnings. Car alarms may aid in the protection of vehicles and the items they hold. Security precautions are also used in prisons to keep control of the inmates.

K.RELAY

A power relay module is an electric device that uses electromagnetic force to function. A separate, low-power signal from a microprocessor activates the magnets. The electromagnet pulls to open or shut an electrical current when it is powered up. One or more connecting pairs, an iron axle that serves as a low resistance conduit for magnetic flux, a wire coil coiled around a soft iron core, or solenoid, and a moveable iron armature make up a basic relay. The movable armature is hinged to the yoke and connected to one or more moving contact groups. The magnetic circuit is broken by the armature, which is kept in place by a spring and de-energized when the relay is switched off.

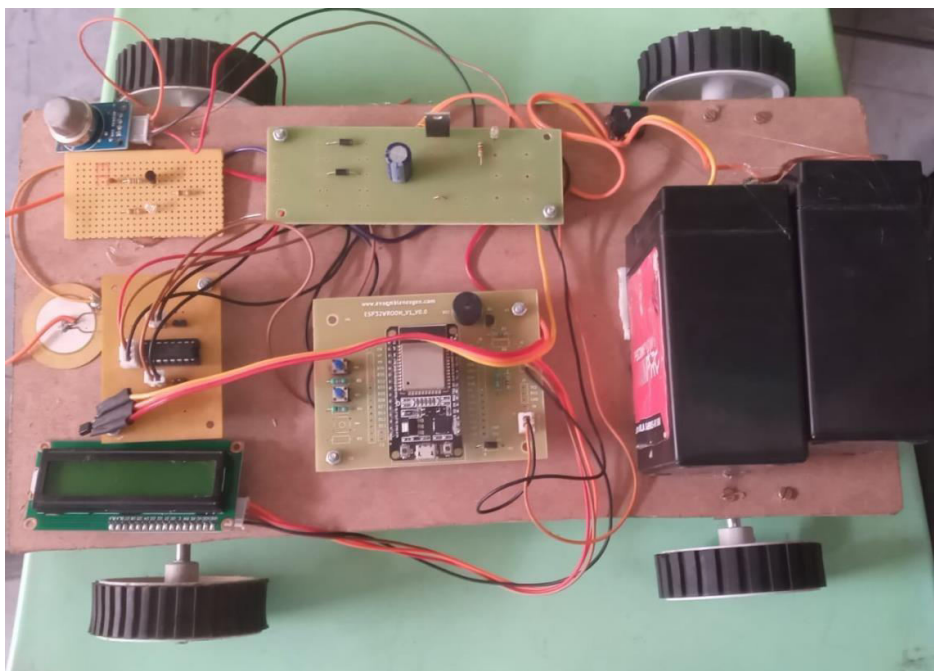


Fig 2 :Hardware implementation of the proposed disaster rescue robot

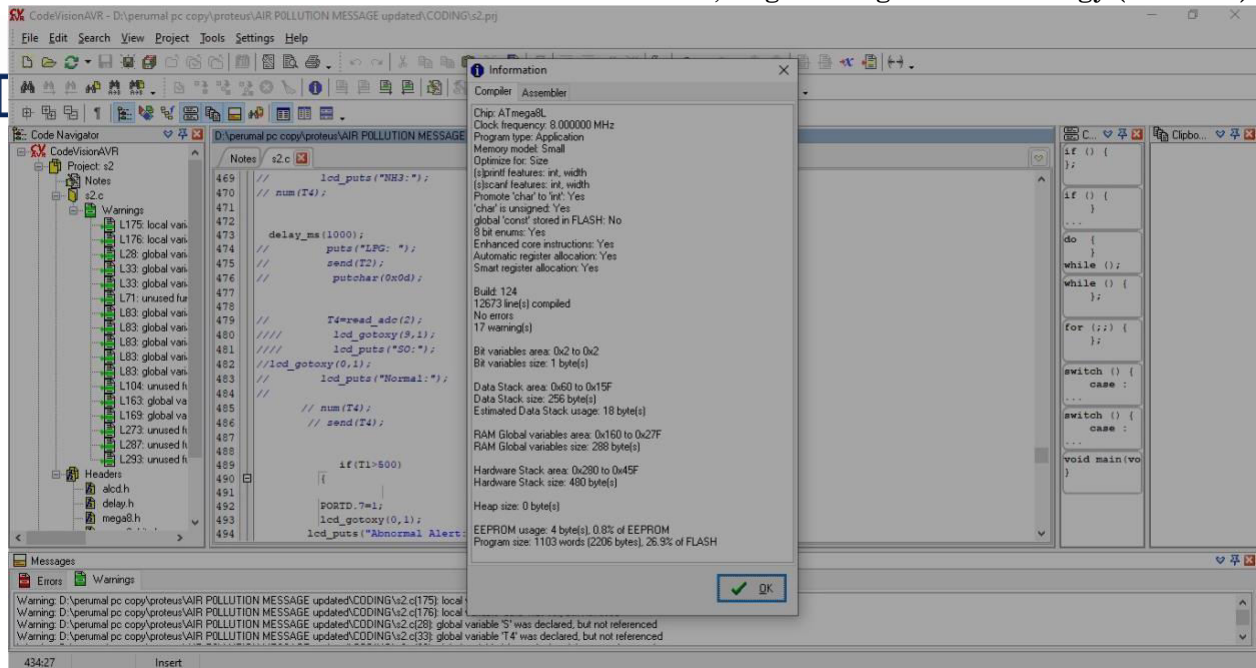


Fig 3:Communication result shown in PC

V. CONCLUSION

The disaster recovery robot system works by utilising fire sensors, gas sensors, and vibration sensors to boost the safety of the employees in the disaster and to keep them safe. The use of IOT allows for continuous monitoring of the disaster and notification of workers. The method is both affordable and effective. The robots may search for victims, investigate risky or low-visibility areas, and provide sensor information for mapping. This additional effort is now focused on supplying data for map creation. This robotic system will have the ability to autonomously navigate through checkpoints and update the path based on the impediments on the path.

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