Design and Development of Real-time Human Detection Robot with LoRa Communication

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Abstract - Robotics is a rapidly developing science that, in a few years, will affect all socioeconomic groups. This project helps people by locating victims during natural disasters like floods and earthquakes by using its developed systems and detection techniques. To find out if the individuals are trapped in a certain area, the project advises utilizing a rescue mobile robot equipped with LoRa connectivity. Due to their small size and ability to travel freely among the wreckage, these robots can pinpoint where those who are trapped beneath the debris are. The robot may be wirelessly communicated, and an ultrasonic sensor will direct its motion to remove obstructions from its route..

Index terms - ***Disaster, LoRa, Microcontroller***

I. Introduction:

Earthquakes happen across the world, inflicting harm and sometimes death on people. Over 550000 persons have reported missing or dying because of earthquakes in the past ten years. Rescue robots are in more demand, although they didn't make any meaningful strides until the 1990s. In actual search and rescue situations, rescue robots are still not frequently deployed, although the sector is quickly developing. Time is of the essence for successful rescue efforts since it might take a long time and be difficult to find and identify people behind rubble. Urban search and rescue operations may be carried out using a variety of methods nowadays. New high-speed technologies and expanding computing power created a viable possibility for novel robot controls and control theory techniques. This project employs a passive infrared sensor to identify people and is built around an 8-bit microcontroller. Four DC Gear motors are utilized to drive the robot, and the microcontroller controls the motors. After the individual in need of assistance is discovered, the authorities are notified through audible alert. The DEBRIS for Earthquake Rescue project is where this project is largely employed. An autonomous robotic vehicle used in the Human Detection Robot project travels through earthquake-prone locations and assists in locating living individuals. It detects human presence using a PIR sensor and alerts the user when a person is nearby. The motor driver is a two-wheel geared driver that may operate in either the forward or backward direction thanks to an attachment of DC motors. The robot can travel in either direction thanks to the geared dc motor's maximum torque and lowest speed, as well as the motor drives with relays that allow for precise turning and forward and backward movement. The primary goal of the research is to identify humans using a wireless, remotely controlled robot that is simple to move about and operate.

II. Literature review:

[1] In the research paper "A design of person detection robot employing sensor," It is mostly based on the AT89C51 microcontroller. They had considered the robot's dual transmitter and dual receiver sections. The robot can be controlled using a remote in the transmitter part. If the remote control is ineffective, the user has the option of using the computer, which can work in both manual and automatic modes. In manual mode, using RS232 logic, the user issues commands; in automatic mode, the robot navigates on its own. To ensure safety, they connected a gas sensor and a fire sensor. A wireless camera was mounted on it, and every few minutes it sends pictures and videos. From the RF receiver it will receive the signal based on commands it will trigger on the way. If any human body is present, the PIR sensor will detect him.

[2] The technology is managed using an Android software application in the paper "Living Person Detection Robot for Rescue Operation". They will instruct the Raspberry Pi by sending commands from the mobile smartphone. They mounted the camera to view the live stream in Robot. They had employed a radar microwave sensor. This programmed will automatically notify the user if any object crosses the radar sensor or if there are any changes to the radar sensor. within its sphere. Temperature sensor and an ultrasonic sensor were utilized to measure the distance from changes that had occurred there. They can tell if a person is still alive or not by taking his temperature.

[3] They have simplified the concept and cut costs in this study named "Human Detection Robot for Disaster Management". Based on the Arduino Uno ATMEGA 328P, this project. The power source is 9 volts. The passive infrared sensor will inform the user by sending a signal to the Arduino when a human body is present within 30 feet of the sensor. A buzzer will then turn on, and an LED will begin to illuminate. "HUMAN TRACE DETECTION" is displayed on the LCD 16X2.

[4] In the study named "RF Controlled Living Human Detection Robot," In this study, a rescue robot is created with the intention of saving people from calamities such as wildfires, tsunamis, earthquakes, collapsing buildings, and victims trapped in them. There are also cases involving deaths brought on by the premature hospitalization of victims. The purpose of this initiative was to aid with rescue efforts in disaster-hit areas, whether they were caused by a natural disaster or a human one. This robot will be able to recognize real people or animals and will be able to locate

people more quickly and accurately. RF transmissions of varying frequencies, depending on the ranging frequency, are used to drive radio frequency robots. Therefore, the name Robots have a wide range of uses, including in the space industry, the medical field, the surveillance industry, and the automotive industry. RF signals are used to drive the RF controlled robot, which is essentially a mobile robot. It is deployed into the disaster region, and each time it locates an alive person (or animal), it notifies the command center, allowing the rescuers to resume their work. PIR sensor, LDR sensor, LED, GSM, GPS, and RF transmitter-receiver are among the components used in this robot. According to the project's goal, the robot will be able to identify a live person and carry out a rescue operation by informing the appropriate authorities of its location. This project aids in performing activities in places affected by natural and man-made disasters during rescue efforts. In comparison to human lives lost and space-consuming high-tech robots, the project is inexpensive. It is easy to comprehend and put into practice the design. In addition to being semiautonomous, it gives the operator control. Solar batteries can be installed as a potential replacement for the rechargeable lead acid battery we now use. As not all places may have access to certain network providers' towers and switching centers, the robot can alternatively be programmed to communicate location information without using GSM. We did our best to make the robot affordable by employing components that are easily accessible, safe (the live stream allows us to see any damage made to the robot), and efficient (it sends messages to the rescue center with the location to assist the human).

[5] This study, "IoT Based Rescue Robot for Alive Person Detection and Health Monitoring System," was published in the journal Science. In this study, they used an Arduino Mega 2560 to build a robot whose primary goal is to find living people during natural and man-made calamities including earthquakes, cyclones, and floods. The robot first walks through an open field in the catastrophe region in search of any affected live people. A camera is used to deliver live video indefinitely. When a calamity strikes, a passive infrared sensor is utilized to determine whether people are moving around. The affected individual must place their finger on the sensors if they are moving for the next pulse and temperature sensor to be able to measure their body temperature and pulse rate. GPS sends the location of the region. 1. The primary goal of the system is to locate any living individuals as quickly as possible to preserve their lives. 2. Use IoT-based alive human detection robots. 3. To create, test, and refine an autonomous robot. 4. PIR sensors are used mostly to detect human beings who are still alive.

[6] This study, "IOT based live people detecting robot for earthquake rescue operation," been published. In this paper, the microcontroller PIR, DC GEAR MOTOR, Internet of Things (IoT), and MAX 232 IC were used. This robot was primarily created to prevent sensor disasters, and it has a PIR sensor attached to see whether anyone is in the area or not. The automation was created using the microcontroller pic 16f877a. It was simple to install the Bluetooth module. This will provide them with information.

[7] In this paper titled "Living human identification robot for rescue operation," it is discussed how emergencies like earthquakes, bomb explosions, and floods frequently result in the loss of priceless human lives, particularly in metropolitan disasters. Several crucial services, like police officers, firefighters, and medical help, etc., are offered to prevent loss of life and property. The first 48 hours of a rescue effort are critical, according to the field of urban search and rescue (USAR). Hence, to make a rescue operation safer and more effective, a rescue robot that can detect and wirelessly interact with the rescue team is proposed. The robot uses a PIR sensor to detect the human body's temperature, which indicates the presence of an alive human body. The message is then delivered via an RF transmitter utilizing a wireless mobile. This project uses a robot built around the p89v51rd23n microcontroller to detect real people. Here, we are utilizing a PIR sensor to find the person, and the robot is following a line that is drawn across the surface. Due to the inclusion of an IR sensor, this project is mostly employed internally in earthquake rescue operations. In this earthquake rescue operation, the IR sensor is employed inside to sense conditions. To help the live person more quickly, the IR sensor is employed to find it and it immediately sends an auditory and visual alarm to the authorities. The microcontroller, which is utilized to receive data from the PIR sensor and drive the motors in accordance with the sensor inputs, controls all of the aforementioned systems. The robot is propelled by two DC motors.

[8] In the study "Microcontroller Based Tracking System" For the Detection of Human Presence in Important Regions," the robot was constructed utilizing an 8-bit microcontroller, the AT89C51. The RF remote control can be used by the user to operate the robot. The robot is linked to the RF receiver component. Whenever we need to give the robot a command. The HT12E in the remote encodes the parallel data into serial data. The HT12D will transform data into parallel form in the receiver section. They have an infrared sensor connected to the robot. When a person is living, their body temperature will be 96 degrees lower, and a buzzer will sound to notify an alert.

[9] In this paper titled "Human Detection Using Wireless Robot," there are numerous types of situations when a person cannot go to inspect, help, or speak a certain action on those points of, we can utilize the robots then we can solve any problems or save lives. They created a system that can decode signals and transfer them to the microcontroller so that controller can control the robot. There must also be a transmitter that can send commands to the robot vehicle. Hence, we are developing a system that will enable us to wirelessly communicate commands, which the robot system will then receive and drive in accordance with.

[10] In the research paper "Human detection robot," A live human detecting robot using IoT is devised and implemented in this article. Heart rate sensors, temperature sensors, PIR sensors, and other sensors are used to detect the affected person, and we also employ an infrared sensor to detect impediments in the way. The camera is utilized to communicate live video and photographs on a continuous

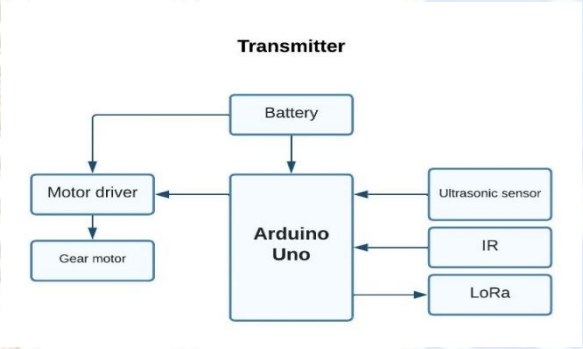
basis, and in our proposed system, they are using GPS to send the current location of the disaster-affected area. They can identify alive people as soon as feasible by utilizing the proposed model, and they can tell the rescue operator of their presence. the affected person's life should be saved. The suggested module is inexpensive, and the necessary hardware components are easily accessible.

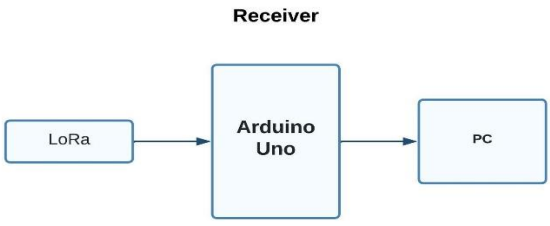
III. Objective of the project:

The primary objective of this project is to identify people and animals who are trapped because of disasters like earthquakes and flooding and alert the appropriate authorities to rescue them.

1. This project intends to provide a workable design for constructing a simpler version of a human detection robot that must be active in catastrophe zones where rescue workers are unable to detect the individuals owing to numerous technical challenges.
2. It is preferable to utilize some high-tech equipment to reach that task swiftly and effectively by finding, searching the victims in such circumstances, when there is a risk of a hazardous environment.

IV. Block Diagrams:





The block diagram of a Real-time person detection robot is shown above.

The transmitter and receiver are the two components that make up the "Real-time person detecting robot".

A PIR sensor, an ultrasonic sensor, and a battery serve as the microcontroller's inputs on the transmitter side of the device. The outputs are the LoRa transmitter to send the signal and the L293D motor drive module to which a DC gear motor is linked for the wheels of the robot's vehicle.

To receive the signals sent by the transmitter, a LoRa receiver is linked to the Arduino Uno microcontroller's receiver side, which is connected to a computer.

The robot is driven by a DC gear motor. The L293D motor driver circuit directs the motor to turn in the direction that the programmed specifies. The robot will steer clear of the obstruction once the ultrasonic sensor picks it up. A passive infrared sensor can identify people. PIR signals, which can be used to measure temperature, are produced by a PIR sensor, a sensing device. This PIR sensor can often detect the heat that a human releases in their natural state. A human generates heat at a temperature of 9 to 10 microns. The detecting angle of a PIR sensor is limited to 1800.

V. Hardware and Software Requirements:

Hardware components required for this robot:

- Arduino Uno
- Motor Driver - L293D
- Gear Motor
- Battery
- Ultrasonic Sensor
- IR Sensor
- LoRa Transmitter
- LoRa Receiver

Software components required for this robot:

- ARDUINO IDE

VI. Applications:

This robot can be used in disaster effected area, war fields, floods areas etc.

- Medical Field
- Industrial Field
- Smart city

VII. Conclusion:

A human detection robot prototype that operates effectively in the situation provided Based on the architecture of the central concept, this prototype robot travels according to passage, estimates obstacles, and is programmed to avoid blocks and proceed through open paths. It is not necessary to use as many sensors or robots because the robot can move and cover a large area. Users can be alerted by constant beeping from the robot when it discovers a human. the presence of a PIR sensor with a 180° field of view, the robot can detect people up to 7 meters away. A video camera attached there allows it to recognize humans. By affixing a visual camera that can capture the image of the intruder, it can recognize humans. It is connected to an ultrasonic sensor that measures the separation between people and objects and can identify an object's infrared picture. During natural disasters, a human detection robot can be employed to save lives.

VIII. References

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