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Energy Efficient Environment Robotic Assistant for Fire Fighters

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ABSTRACT: Fire incidents are very frequent nowadays, and it can be difficult for a firefighter to save someone's life. It is impossible to nominate someone to constantly monitor when an unintended fire has begun, while a computer might. The robot would be able to sense fire from afar. These robots are mostly used in the manufacturing industry. The planned vehicle is capable of detecting fire and immediately extinguishing it. It is possible that when travelling towards the source of fire, it will encounter any barriers, in which case it will be able to stop them. It uses ultrasonic sensors to track obstacles. IoT is used to monitor the status of a fire fighting robot.

KEYWORDS:- IoT, NodeMCU, Buzzer and Sensors

I. INTRODUCTION

A robot is a multifunctional, reprogrammable system that can be configured to perform a number of tasks. It is an autonomous computer or a system in the shape of a person that executes tasks usually attributed to humans. Owing to physical limitations and unfavourable circumstances during fire emergencies, fire extinguishing is a very challenging process for humans. For more than half a century, robotics has become a mainstay in advanced technology. Robots are constantly being used for entertainment, military, and surveillance purposes as their peripheral technology becomes more advanced, efficient, and miniaturized. "An automated unit that executes tasks usually ascribed to humans or a computer in the form human," according to Webster. In general, it is a computer that operates without the presence of a living human. Robots are used for specialized activities that require high precision and speed, such as managing dangerous conditions. Human error is usually the cause of a dangerous accident. Intelligent remote monitoring technology is being designed to incorporate real-time border defence inspection and surveillance. On the robot car, our device consists of a sensory network, an embedded machine, and intelligent software. When the robot side (i.e. VEHICLE SIDE) detects a divergence from the original state of the sensors, it sends signals to the remote side (i.e. USER SIDE), where the sensed quantity is shown on the LCD [1]-[5].

The concept of a completely automatic fire fighting robot is presented in this report, which includes numerous modules such as a temperature sensor LM35, a microcontroller PIC 16F8778, a 16*2 LCD, and a 433 MHz RF (Radio-Frequency) module. The motions are produced by a 12V dc motor. When the robot detects a fire in a specific region, it immediately moves to that zone with the aid of wheels attached to the robot by a dc motor. All of the study project's modules are installed on a single ply frame, including the RF transmitter and receiver unit, temperature sensor with LCD interface, and dc motor control unit. Each module's PCB (Printed Circuit Board) schematic is created with the help of software. In this investigation, all phases of designing a firefighting robot are explored in detail. The design and implementation of an SMS-based robotic device for hole detection in surface pipes using GPS/GPRS/GSM technology was presented in this article. Surface pipes are used to carry fluids in today's industries; each of these pipelines have welded-together joints. Fluid leakage can occur if the welding is not performed perfectly, resulting in product failure and downtime. To address the problem of pipeline leakage, an SMS-based robotic system is designed to inspect pipelines for holes, and if light is detected in the pipelines by the robot's sensing devices, an SMS indicating the location where the light was detected is sent to the operator's phone through the SIM 900 GPS/GPRS/GSM MODEM installed on the robot hardware. The robot system is comprised of an Arduino Uno Microcontroller and a variety of sensing instruments. The system is written in the embedded C programming language. The robot device was checked after it was implemented, and it was found to be capable of detecting gaps in surface pipes and sending a short message to the personnel's cell phone.

Detecting and extinguishing fires is a hazardous task that puts a fire-fighter's life in jeopardy. Every year, thousands of fire-fighters around the globe risk their life in the line of duty as a result of fires. Robotics is the product of research and development in the area of Artificial Intelligence. Robots are used in a variety of fields, including manufacturing, medicine, and industry. As a result, robotics will be used to support fire fighters in performing this mission, reducing the danger to their life. Fire Fighter is a robot that was created to work under certain harsh environments. It can be managed and monitored remotely and has the capacity to extinguish fire until the cause of the fire has been identified. It comes with a control device and uses a wireless networking system to run. The sensors installed on the fire-fighter robot are used to develop the fire alarm device. The Android program is used to operate the robot autonomously. Because of its strong capability and transparent platform, Google's Android cell phone platform has gained prominence among software developers. As a result, Android is an excellent tool for controlling robotic systems. Android has a lot of money and already has a lot of sensors built in. When a fire happens, the proposed Fire alarm device senses the existence of smoke in the air and collects photographs through a camera mounted within a room. Raspberry Pi and Arduino Uno were the embedded devices used to build this fire alarm device. The ability to remotely transmit an alarm when a fire is observed is a core function of the device. Where smoke is observed, the device generates a web page with a picture of the current condition of the space. To report the incident to the Fire-fighter via Short Message Service, the device will need user confirmation (SMS). The benefit of utilizing this method is that it reduces the likelihood of a false alarm being communicated to a fire-fighter. This machine can only use a small amount of data and power since the sensor can only take a picture [6]-[10].

This paper introduced a path-following two-wheeled lightweight portable robot with an ArduinoNano as the central driving functional device and innovative features such as wireless control utilizing a Wi-Fi and Bluetooth module, as well as crash detection, avoidance, and control features to include the unique skill of danger avoidance, dropping from a height with increased stabilization and precision control. With data collection and analysis facilities, the highly advanced architecture allows for very successful balanced travel on horizontal land terrain surfaces. The architecture incorporates infrared sensors, Bluetooth modules, and Wi-Fi modules, as well as dc gear motors to monitor the vehicle's speed and avoid colliding with any obstacles detected along the robot's direction [11]-[12]. It has the unique ability to run in a maze with route tracking abilities that can be managed remotely using Wi-Fi for long range control and Bluetooth for short range control from any remote location. An entire device is developed and implemented in this research paper, in which movement is stable regulated dependent on input from an infrared transceiver module.

II. RELATED WORK

Humans will monitor the robot using the Bluetooth module in the current setup. The Android application is compatible with the Bluetooth module. This Bluetooth model uses a running engine, a voltage divider, tires, Bluetooth, and a motor driver to connect with an Android application. The project's aim is to use an android to operate a robotic vehicle. For detecting the signals sent by the android program, a Bluetooth module is connected to the robot's control unit. This information is sent to the control unit, which controls the robot's movement. At the receiver end, commands are used to guide the robot in both directions. Two motors that are connected to the microcontroller shift. The data is sent serially by the Android application and retrieved by a Bluetooth receiver connected to the transmitter. The microcontroller software interfaced with the serial data to produce appropriate outputs based on the input data in order to operate the motors using motor driver integrated circuits. The engine driver IC connects the engines to the control unit.

III. PROPOSED SYSTEM

Proposes an arduino uno-based real-time firefighting robot. Sensors such as a fire sensor, a gas sensor, and an ultrasonic sensor are used in this robot device. During the robot's operation, a fire sensor is used to detect fire, and an ultrasonic sensor is used to detect obstacles. The water pump motor extracts water from the bottle and delivers it to the nozzle, which sprays water on the fire to put it out. A buzzer is used to signal that there is a burn. With the assistance of the node MCU, the sensed data is uploaded to the IOT website. The robot can act in accordance with the IOT.

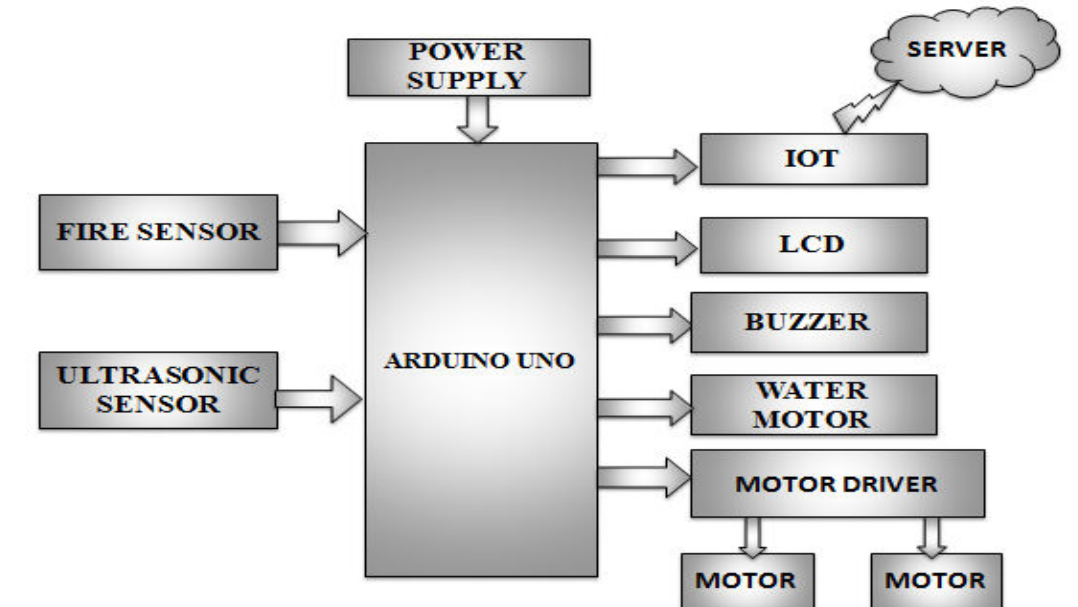


Figure.1. Block Diagram of Proposed System

A CPU another Arduino/Genuino board or other microcontrollers may all be communicated with using the Arduino/Genuino Uno. On optical pins 0 (RX) and 1 (TX), the ATmega328 supports UART TTL (5V) serial communication (TX). This serial connectivity is channelled over USB by an ATmega16U2 on the board, which appears to software on the device as a virtual com port. There is no requirement for an additional driver since the 16U2 firmware uses normal USB COM drivers. On Windows, however, a.inf file is needed. A serial display is included in the Arduino Software (IDE), which enables basic textual data to be transmitted to and from the board. As data is transferred through the USB-to-serial chip and USB link to the device, the RX and TX LEDs on the board can glow (but not for serial communication on pins 0 and 1). All of the Uno's digital pins may be used for serial contact with the aid of a Software Serial library. A flame or fire detector is a sensor that detects and reacts to the presence of a flame or fire. Sound an alert, deactivating a fuel line (such as a propane or natural gas line), and triggering a fire control device are all possible responses to a perceived blaze, depending on the installation. There are several techniques for detecting flames. Ultraviolet detectors, near-IR series detectors, infrared (IR) detectors, infrared thermal cameras, UV/IR detectors, and so on are some of them. When a fire fires, it releases a tiny amount of infrared radiation, which is detected by the sensor module's Photodiode (IR receiver). So we use an Op-Amp to scan for voltage changes around the IR Receiver, such that if a fire is observed, the output pin (DO) will be 0V(LOW), and if there isn't, the output pin will be 5V(HIGH).

This flame sensor is built on infrared technology. It uses a YG1006 sensor, which is a high-speed, high-sensitivity NPN silicon phototransistor. It detects infrared light with a wavelength of 700nm to 1000nm and a detection angle of around 60 degrees. A photodiode (IR receiver), resistor, capacitor, potentiometer, and LM393 comparator are all built into a flame sensor module. The on-board potentiometer may be used to modify the sensitivity. For a digital output, the working voltage is between 3.3v and 5v DC. The appearance of blaze or fire is indicated by logic high on the output. Low performance logic means the absence of blaze or flames. Node MCU is an open source hardware board with a LUA-based interactive firmware for the Express if ESP8622 Wi-Fi SoC, as well as a LUA-based interactive firmware for the Express if ESP8622 Wi-Fi SoC. The ESP8266 Wi-Fi modules come with a CP2102 TTL to USB chip for programming and debugging, are breadboard-compatible, and can be driven via the micro USB connection. Espresso if Systems produces the Node MCU, a wifi SOC (system on a chip). It's built around the ESP8266 -12E Wi-Fi card. It's a fully engineered processor that's built to fit into a compact box and have complete internet access. It can be configured using LUA programming or the Arduino IDE directly via the USB port. We can create a Wi-Fi link and specify input/output pins according to your needs using basic programming, just like an Arduino, and transform it into a web server, among other things. The Ethernet module's Wi-Fi counterpart is the Node MCU. It integrates the functions of a Wi-Fi connection point and station with the capabilities of a microcontroller. The Node MCU is a really

good platform for Wi-Fi networking because of these features. It may act as an entry point and/or station, as well as host a web server and link to the internet to retrieve or upload data. A buzzer or beeper is an electronic signaling system that is often used in cars, kitchen appliances such as microwave ovens, and game shows. It typically consists of a series of switches or sensors connected to a control device that decides whether and which button was pressed, or whether a preset period has elapsed, and normally illuminates a light on the relevant button or control panel, as well as sounding an alert in the form of a constant or occasional ticking or beeping tone. Originally, this instrument used an electromechanical mechanism that was similar to an electronic bell but didn't include the metal gong (which makes the ringing noise). This units were often anchored to a wall or ceiling and used it as a sounding board.

IV. RESULTS AND DISCUSSION

Every programming language for a compiler that outputs binary machine code for the target processor may be used to write Arduino software. AVR Studio and the newest Atmel Studio are Atmel's programming environments for their microcontrollers. The Arduino integrated development environment (IDE) is a cross-platform framework written in the Java programming language that is provided by the Arduino project. It arose from the IDE for the Processing and Wiring programming languages. It comes with a code editor that involves text cutting and pasting, text searching and replacement, automated indenting, brace matching, and syntax highlighting, as well as one-click compiling and uploading to an Arduino board. A messaging field, a text console, a toolbar with standard feature keys, and a hierarchy of service menus are also included. A sketch is Arduino software created with the Arduino IDE. On the production platform, sketches are saved as text files with the extension.ino, while Arduino Software (IDE) pre-1.0 saved sketches with the extension.pde. The Arduino IDE uses unique code structuring rules to help the languages C and C++. The Wiring project includes a program library that is included with the Arduino IDE that provides several standard input and output procedures. User-written code only needs two simple functions to start the sketch and the key software loop, which are compiled and connected into an executable cyclic executive program with the GNU tool chain, which is also provided with the IDE distribution. The Arduino IDE uses the argued software to translate executable code into a text file in hexadecimal encoding, which is then loaded into the Arduino board's firmware through a loader program. Software written in assembly language can be understood by the microcontroller, but it must be converted into a language with zeros and ones. The words Assembly language and Assembler are not interchangeable. The first is a compilation of rules for writing microcontroller programs, while the second is programming software that converts assembly language statements into zeros and ones. Machine Code is another name for a compiled application. The same instruction is expressed in machine code by a 14-bit string of zeros and ones that the microcontroller may recognize. Both assembly language commands are assembled into an array of zeros and ones in the same way. An "executive disk," also known as a "HEX text file," is a data file used to store compiled programs. The term is derived from the hexadecimal representation of a data file which includes the suffix "hex," as in "probe.hex." The data file is then loaded into the microcontroller using a programmer after it has been created. Assembly language programs can be written in any text processing (editor) software that can generate ASCII data files on a hard disk, or in a different work environment like MPLAB, which will be discussed later. When we look around, we note that we are surrounded by different forms of embedded systems. Any electronic device, from a digital camera to a cell phone to a washing machine, contains a processor. Embedded software is associated with each processor. If the body of an embedded device is made up of electronics, the brain is made up of embedded processors, and the spirit is made up of embedded software. Embedded software is responsible for the majority of the functionality of embedded devices. Programs were written in assemblers and fused into EPROMs during the early days of microprocessor-based systems. There used to be no way to figure out what the machine was up to. To ensure that the software was executed correctly, LEDs, switches, and other devices were used. Few 'lucky' engineers had In-circuit Simulators (ICEs), but they were prohibitively expensive and unreliable. Compilers for embedded C may generate files that can be downloaded to the microcontrollers/microprocessors on which it must operate. Embedded compilers have access to all tools that are not used in desktop machine compilers.

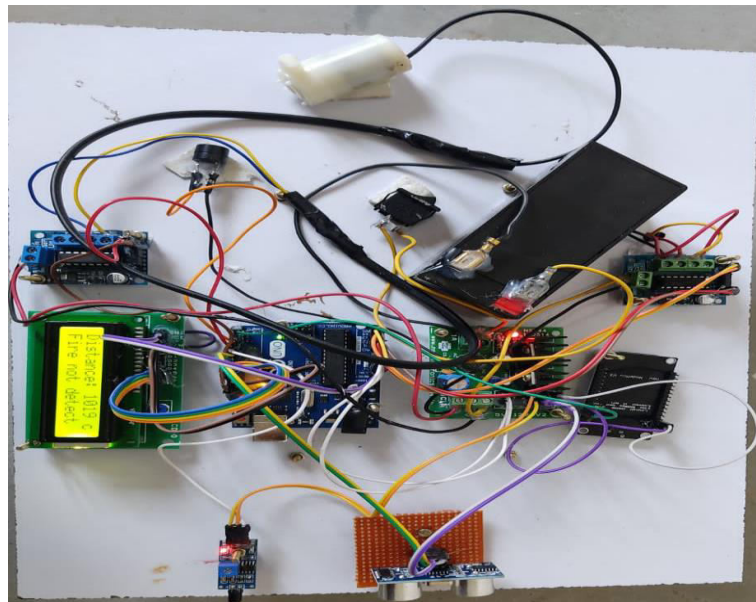


Figure.2. Hardware Kit of Proposed System

V. CONCLUSION

The device is developed and tested in this work for its efficacy as well as scalability due to advances in sensor technology. The usage of cutting-edge technologies will aid in reducing the damage caused by fire in this project. The device is more effective and useful as IOT sensor technology improves. As a result, our Robot is able to sense the existence of fire and obstacles. When a fire is observed, the water pump engine immediately turns on to put out the fire. Both of these parameters are shown on the LCD panel, and in the event of a dangerous situation, we receive a warning to warn the operator via IOT, as well as robot function dependent on IOT commands.

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