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FIRE FIGHTING ROBOT CONTROLLED BY BLUETOOTH

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ABSTRACT

In today's world robotics are an expeditious growing and fascinating field. The robot has ample astuteness to cover the maximum area of provided space. It has ultrasonic sensors which are habituated to sense the obstacles coming in between the path of the robot. Autonomous perspicacious robots are robots that can perform desired tasks in unstructured environments without perpetual human guidance. The minimum number of gear motor sanctions the ambulating robot to minimize the potency consumption while constructing a program that can engender coordination of multi-degree of liberation for the kinetics of the robot. In this work It is found that the two formats are adequate to engender the rudimental ambulating robot and one voltage regulators are needed to control the load where it is capable of supplying enough current to drive two gear motors for each wheel. Bluetooth-controlled firefighting robot is to remotely extinguish fires in hazardous environments to reduce human threats and reduce human efforts. It can navigate through obstacles and reach areas that are difficult for firefighters to access. The robot's Bluetooth control enables safe operation from a distance, reducing the risk to human firefighters.

1 INTRODUCTION

The A Fire extinguisher's life is frequently at danger when they are detecting and putting out fires. The goal of this project is to provide a technical resolution to the before mentioned issue. A robot is a mechanical device that can perform a complex series of tasks automatically, particularly one that can be programmed by a computer. A Bluetooth-controlled robot with a small fire extinguisher unit attached is referred to as a fire extinguisher robot. This mobile robot may be moved and navigated using a mobile phone's Bluetooth module. At the point when it shows up at the fire, the fire sensor distinguishes it and conveys a message to the douser units to initiate the siphon and shower water. The whole framework is set up using an Arduino UNO board which shapes the mind of the framework. Robots are machines that resemble humans and carry out a variety of difficult activities. Robots come in a wide variety of kinds, including stationary robots, mobile robots, underwater robots, humanoid robots, space robots, and medical robots A FIRE EXTINGUISHER ROBOT is suggested in this. This robot has an IR flame sensor that detects fire in the environment and sends signals to the microcontroller, which activates the pump and sprays water on the fire to put it out. Through a Bluetooth module, a cell phone can control this robot. This robot embodies the principles of proportional motor control and environmental fire sensing. The robot's motors are controlled in both directions by the motor driver. The robot receives all motion control instructions via the Bluetooth module. As a result, the robot analyses data from its numerous major hardware

components, including motors and a flame sensor, using an Arduino Uno board (microcontroller). The Arduino C programming language, which was adapted from C and C++, is used to program the robot.

1.1 Applications of embedded systems

- Manufacturing and process control
- Construction industry
- Transport
- Buildings and premises
- Domestic service
- Communications
- Office systems and mobile equipment
- Banking, finance and commercial
- Medical diagnostics, monitoring and life support
- Testing, monitoring and diagnostic systems

2. LITERATURE SURVEY

Muhammad Sarmad Hassan et al. [1]In this paper, we presented a method of a human following robot based on tag identification and detection by using a camera. Intelligent tracking of specified target is carried out by the use of different sensors and modules i.e. ultrasonic sensor, magnetometer, infrared sensors and camera. An intelligent decision is being made by the robot control unit based on the information obtained from the above sensors and modules, hence finding and tracking the particular object by avoiding the obstacles and without collision.

Denny Irawan1 et al. [2] aims at designing a robot to track an object based on colour detection. Robots have been developed by several countries throughout the world. Among them are humanoid robots, bioloid, including the type of mobile robot. Mobile robots are widely used in several studies equipped with various sensors, including using ultrasonic sensors and cameras. This aims to help create intelligent autonomous behavior and movement control which makes it very important for the application of mobile robots discussed. The camera is one type of hardware that can be used as a sensor to help identify the surrounding environment and can be connected with C #. C # programming language functions as digital image processing and produces an output that will be used as a control reference to follow a target based on colour on human follower robots. C # also has an open source library, one of which is AForge.NET.

Chandrasekhar pati et al. [3] aims on vision based robot following using PID Control. Applications like robots which are employed for shopping, porter services, assistive robotics, etc., require a robot to continuously follow a human or another robot. This paper presents a mobile robot following another tele-operated mobile robot based on a PID (Proportional–Integral-Differential) controller. Here, we use two differential wheel drive robots; one is a master robot and the other is a follower robot. The master robot is manually controlled and the follower robot is programmed to follow the master robot. For the master robot, a Bluetooth module receives the user's command from an android application which is processed by the master robot's controller, which is used to move the robot.. The follower robot receives the image from the Kinect sensor mounted on it and recognizes

the master robot. The follower robot identifies the x, y positions by employing the camera and the depth by using the Kinect depth sensor.

Saranya et al. [4]aims at human tracking robot using wifi. Formerly, dogs were used because of their highly sensitive nature. One major drawback was dogs couldn't work independently; they need human assistance. It means, the need is totally or partially independent to human factor. P.Velrajkumar and A.Darwin Jose Raju proposed a remote device controlling robot using RF technology; it gives a command from laptop to controller. It also has a camera unit which is used for tracking and image can be seen on laptop Rupnar Pallavi Sharad and Prof.Throat P.R proposed a remote controlled robot using Zigbee transceiver and a wireless camera. It has a PIR sensor unit which is used for human detection.

Gao, Shang et al. [5]aims on fire-fighting robots are useful in situations where it is too dangerous or has difficult access for fire fighters. Modular design based on proximity, vision and IR sensors has been incorporated into a fire-fighting model. The robot sprays water from manipulator to extinguish flame. Software consists of integrated tracking, obstacle avoidance, flame detection and motion algorithms. Through testing, it is possible to run in a realistic scene simulated in the lab and to detect and extinguishment the flame. Robot can transfer video to remote location

Aliff, Mohd et al. [6]aims on Fire incident is a disaster that can potentially cause the loss of life, property damage and permanent disability to the affected victim. They can also suffer from prolonged psychological and trauma. Fire fighters are primarily tasked to handle fire incidents, but they are often exposed to higher risks when extinguishing fire, especially in hazardous environments such as in nuclear power plant, petroleum refineries and gas tanks.

CHAPTER 3 OBJECTIVE OF THE PROJECT:

- To find fire in the region vulnerable to disasters.
- When fire is detected, it is put out.
- Lowers the amount of devastation and labor effort put out by humans, as well as the harm done to human life.
- To design the 360 degrees fire fighting robot using catia software
- Fabrication the all components and assembly the all parts
- To utilize flame sensors to detect fire.
- To automatically put out a fire when one is detected

CHAPTER 4 COMPONENT REQUIRED:

- Microcontroller board-Arduino uno
- Motor driver IC
- Two DC Gear Motor
- Power Supply (12 volt battery)
- Wheels
- Robot Chassis
- Fire sensor
- Bluetooth Module

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- Relay
- Pump Motor
- Jumper Wires

DC MOTOR:

A DC motor, short for Direct Current motor, is a type of electric motor that converts electrical energy into mechanical energy. Unlike alternating current (AC) motors, which rely on alternating current to generate a rotating magnetic field, DC motors operate using a direct current power source.
Here's a brief introduction to the key components and working principles of a DC motor:

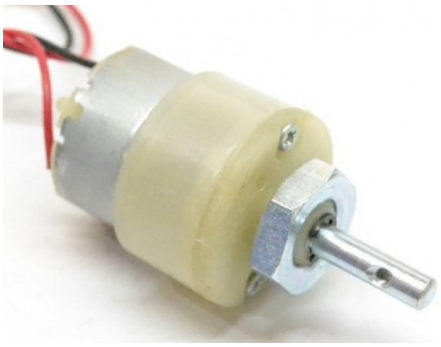

Figure 1 DC Motor

ARDUINO:

Arduino is an open-source electronics platform based on easy-to-use hardware and software. It consists of a microcontroller board and a development environment that allows users to write, upload, and execute code to control various electronic components and devices.

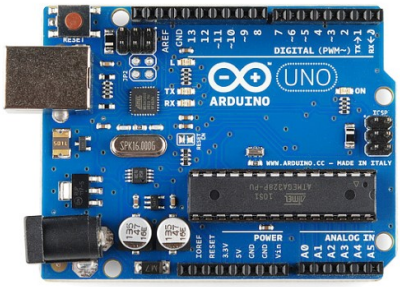

Figure 2 Arduino

MOTOR DRIVERS:

The L298N motor driver module is a popular dual H-bridge motor driver that allows you to control the direction and speed of two DC motors independently. It's widely used in robotics and other projects where precise motor control is required.

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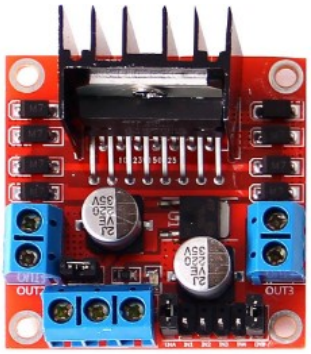

Figure 3 Motor driver

Here's an overview of the L298N motor driver module and how it works:

H-Bridge Configuration: The L298N module consists of two H-bridges, which are electronic circuits that allow you to control the direction of a motor by toggling the polarity of the voltage applied to it. Each H-bridge can control one DC motor.

BLUETOOTH:

The HC-05 Bluetooth module is a popular and widely used Bluetooth serial communication module. It allows devices to communicate wirelessly over Bluetooth, making it suitable for various applications, including wireless data transfer, remote control, and IoT (Internet of Things) projects.

Figure 4 Bluetooth module

WHEELS:

This is the 10 x 4 cm gear motor robot wheel. The wheel can be used with the motors having 6mm shaft, The diameter of the wheel is 100 mm and the width is 40 mm including the rubber grip as well. These wheels are great for makers, hobby engineers, and anyone who wants to build small car projects. Suitable for running on the ground, good wear resistance, perfect replacement for your kit. These wheels are High-quality PCB FR4 Grade with FPT Certified, easy to mount, durable and cheap. With 6mm hole for the shaft and the screw for fitting making it very easy to mount on motors.

Features:

- Light weight
- Durable
- Smooth surface

Applications:

- Gear motor robot
- Robot cars

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- used for robots

100x40mm Wheels For 6mm Shaft For Robotics DIY For 12V DC Gear Motor

Figure 5 Dummy wheel

5 SOFTWARE IMPLEMENTATION

5.1 Arduino Uno on the Arduino Desktop IDE

If you want to program your Arduino Uno while offline you need to install the Arduino Desktop IDE The Uno is programmed using the Arduino Software (IDE), our Integrated Development Environment common to all our boards. Before you can move on, you must have installed the Arduino Software (IDE) on your PC, as explained in the home page of our Getting Started. Connect your Uno board with an A B USB cable; sometimes this cable is called a USB printer cable.

The USB connection with the PC is necessary to program the board and not just to power it up. The Uno automatically draw power from either the USB or an external power supply. Connect the board to your computer using the USB cable. The green power LED (labelled PWR) should go on.

5.2 Install the board drivers

If you used the Installer, Windows - from XP up to 10 - will install drivers automatically as soon as you connect your board. If you downloaded and expanded the Zip package or, for some reason, the board wasn't properly recognized, please follow the procedure below.

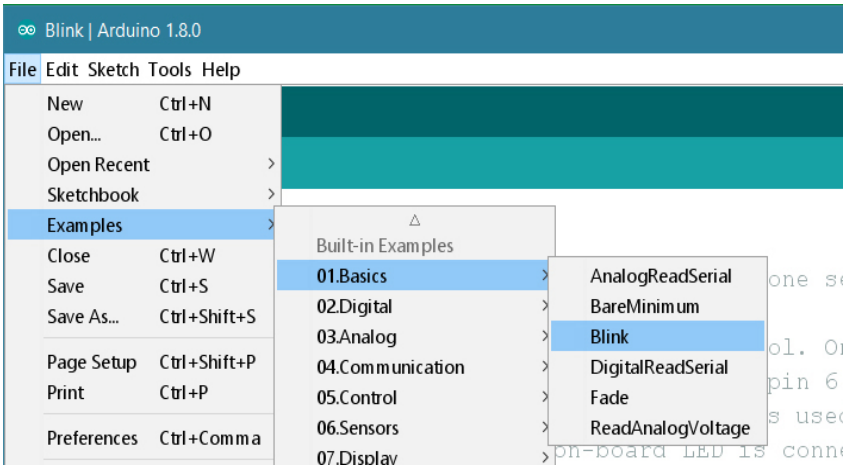

Figure 6 Select the board driver

Click on the Start Menu, and open up the Control Panel. While in the Control Panel, navigate to System and Security. Next, click on System. Once the System window is up, open the Device Manager. Look under Ports (COM & LPT). You should see an open port named "Arduino UNO (COMxx)". If there is no COM & LPT section, look under "Other Devices" for "Unknown Device".

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Right click on the "Arduino UNO (COmxx)" port and choose the "Update Driver Software" option. Next, choose the "Browse my computer for Driver software" option. Finally, navigate to and select the driver file named "arduino.inf", located in the "Drivers" folder of the Arduino Software download (not the "FTDI USB Drivers" sub-directory). If you are using an old version of the IDE (1.0.3 or older), choose the Uno driver file named "Arduino UNO.inf" Windows will finish up the driver installation from there. Open your first sketch and then open the LED blink example sketch: File > Examples >01.Basics > Blink.

5.3 Select your board type and port

You'll need to select the entry in the Tools > Board menu that corresponds to your Arduino board. Select the serial device of the board from the Tools | Serial Port menu. This is likely to be COM3 or higher (COM1 and COM2 are usually reserved for hardware serial ports). To find out, you can disconnect your board and re-open the menu; the entry that disappears should be the Arduino board. Reconnect the board and select that serial port.

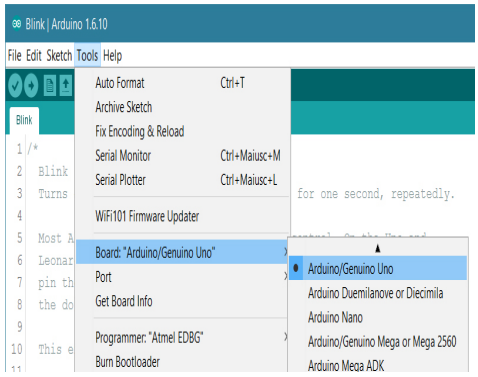

Figure 7 Select the type of board

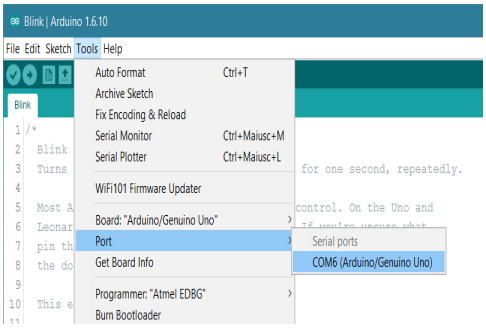

Figure 8 Select the COM port

6 DESIGN AND FABRICATION OF ROBOT

6.1 DESIGN

6.1.1 Introduction to CATIA:

CATIA, which stands for Computer-Aided Three-Dimensional Interactive Application, is a multi-platform software suite developed by the French company Dassault Systems. It is widely used in the aerospace, automotive, shipbuilding, industrial equipment, and other industries for designing, modelling, and simulating products in 3D. CATIA is renowned for its advanced capabilities in

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product design, surfacing, engineering, and manufacturing. It offers a comprehensive set of tools for designing complex shapes, analysing designs for performance and manufacturability, and creating detailed engineering drawings.

6.2 Design of Robot:

6.2.1 Dimensions of the Robot:

Length = 300mm
Width = 150mm
Height = 120mm

6.2.2 Sketching:

Use the Sketcher workbench to create 2D sketches of the robot's components, such as the chassis, wheels, and firefighting mechanism.

Ensure that the sketches adhere to the specified dimensions and constraints.

6.2.3 Part Design:

Use the Part Design workbench to extrude or revolve the 2D sketches to create 3D models of the robot's components.

Apply fillets, chamfers, and other features to refine the shapes of the components.

6.2.4 Assembly Design:

Use the Assembly Design workbench to assemble the individual components into the complete robot assembly.

Use constraints such as coincident, tangent, and distance to properly position the components within the specified dimensions.

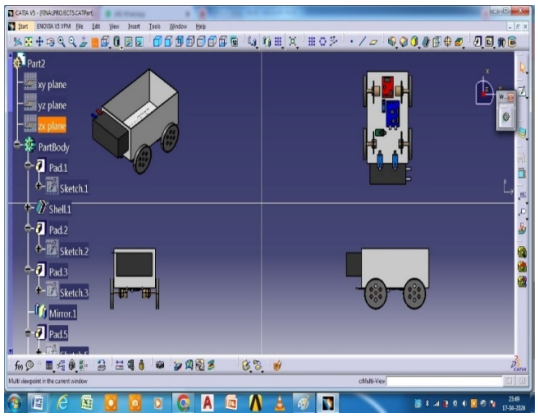

Figure 9 Orthographic views of ROBOT

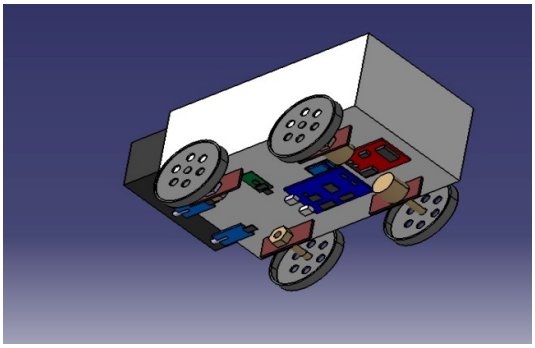

Figure 10 Bottom View of ROBOT

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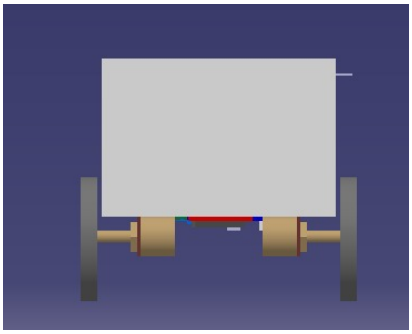

Figure 11 Front View of ROBOT

6 FABRICATION OF ROBOT:

6.1 Marking and cutting of Iron metal Sheet:

To create the frame for fire-fighting robot with dimensions of 120mm in height, 150mm in width, and 300mm in length, we will need a 3mm thick iron sheet. The cutting process involves marking the dimensions on the iron sheet and using a cutting tool suitable for 3mm thick material, such as an electric shear, plasma cutter, or angle grinder with a cutting disc, to cut along the marked lines. Ensure to wear appropriate safety gear such as gloves and goggles during the cutting process. Once cut, you can bend the iron sheet along the edges to form the rectangular shape of the frame.

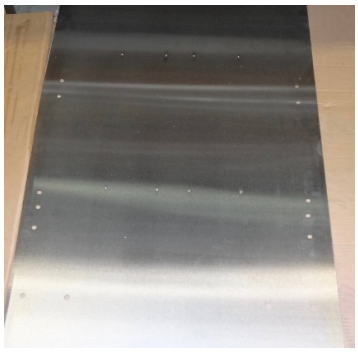

Figure 12 Metal sheet Cutting

6.2 Welding:

Welding is a fabrication process that joins materials, typically metals or thermoplastics, by causing fusion. This is done by applying heat, pressure, or both, and often adding a filler material to form a pool of molten material (the weld pool) that cools to become a strong joint. There are several types of welding processes, each with its own advantages and applications

Figure 13 Folding of sheet metal

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6.3 Arc welding for theRobot:

To weld the frame of fire-fighting robot with dimensions of 120mm in height, 150mm in width, and 300mm in length using arc welding, start by preparing the 3mm thick iron sheet, ensuring it's cut to the required dimensions. Clean the surfaces to be welded to remove any contaminants. Set up the arc welding machine, selecting the appropriate electrode and adjusting settings such as amperage and voltage based on the material thickness. Position the frame pieces correctly and clamp them together securely. Weld the joints using the arc welding machine, moving the electrode along the joint to create a continuous weld. Ensure proper penetration and fusion of the weld. Inspect the welds for quality and strength, making any necessary adjustments. Finish the frame by grinding or filing any rough edges. Finally, assemble the robot components onto the frame and test its functionality.

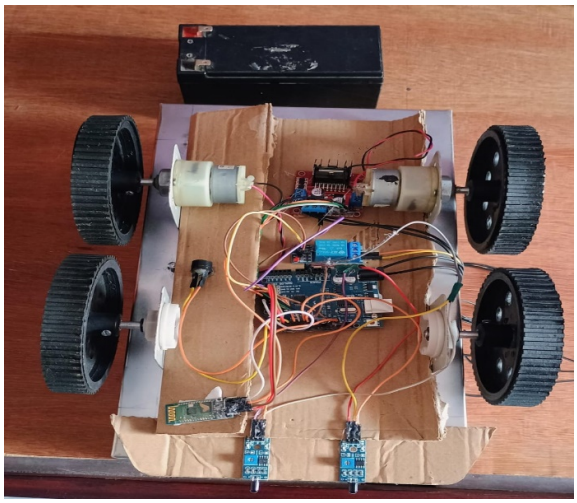

Figure 14 Assembly of components

7 CONCLUSION

The objectives are successfully achieved by the prototype. With a very quick response this will be functional on its own overcoming the constraints. The Integration of Bluetooth module for manual work and many components for automated work has increased the performance and accuracy of the bot. It will work as direct assistant to the fire fighters. This bot can save lives make their work easy and effective. The proposed strategy has been carried out in a model means and has been controlled from an extremely significant distance. Its precision and effectiveness levels are most extreme with an insignificant time after the fire is distinguished. The robot's compact design, efficient navigation system, and ability to detect and extinguish fires autonomously make it a valuable addition to fire-fighting equipment. With further refinement and integration of advanced sensors and materials, these robots have the potential to revolutionize firefighting operations, reducing risks to human life and property in hazardous environments. As technology continues to evolve, the future holds even greater promise for the role of robots in ensuring safety and security in various industries.

7.1 FUTURE SCOPE

The future of firefighting robots holds great promise, with advancements in technology enabling robots to assist in firefighting operations in various ways. Some key areas of development and potential future applications include:

1. **Autonomous Fire Suppression:** Robots equipped with sensors and AI can navigate through complex environments, locate fires, and deploy extinguishing agents, reducing the risk to human firefighters.
2. **Remote Sensing and Monitoring:** Robots can be used for remote sensing and monitoring of fire-prone areas, providing real-time data to firefighters for better decision-making.
3. **Search and Rescue Operations:** Robots can navigate through hazardous environments to locate and rescue individuals trapped in buildings or other structures during a fire.
4. **Infrastructure Inspection:** Robots can be used for post-fire inspections of infrastructure, assessing structural integrity and identifying areas needing repair.
5. **Collaborative Robotics:** Robots can work alongside human firefighters, performing tasks such as carrying equipment, providing situational awareness, and assisting in firefighting efforts.
6. **Miniaturization and Adaptability:** Future robots may be smaller, more agile, and able to adapt to a variety of environments, including confined spaces and rugged terrain.
7. **Advanced Materials and Extinguishing Agents:** Robots may be designed with advanced materials and extinguishing agents to improve their effectiveness in firefighting operations.

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[9]Saranya, 2G. Kiruthikamani and 3P.Devi, 1,2,3Assistant Professor Department of Electronics and Communication Engineering, Sri Ramakrishna Institute of Technology, Coimbatore, IndiaWiFi Based Human Tracking Robot