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FIRE FIGHTING ROBOT

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Abstract— **The Project is designed to develop a Low-Cost firefighting Robot using Bluetooth technology for remote operation. Bluetooth HC-05 module is used for this purpose. The robotic vehicle is loaded with water tanker and a pump which is controlled over wireless communication to sprinkle water. At the transmitting end using push Bluetooth app, commands are sent to the receiver to control the movement of the robot either to move forward, backward and left or right etc. At the receiving end four motors are interfaced to the micro controller where two of them are used for the movement of the vehicle. A water tank along with water pump is mounted on the robot body. The whole operation is controlled by an ATMEGA328 series micro-controller. A motor driver IC, L293D is interfaced to the micro-controller through which the controller drives the motors. We are using ESP32 MCU and camera module to process the real time video transmission. The transmitted video can we streaming on IP network.**

Keywords— **Low-Cost firefighting robot, Wireless Communication, Remote Operation, Live Feedback**

I. INTRODUCTION

This project aims to overcome the drawbacks of previous firefighting robots and create a cost-effective prototype that can be implemented in real-time. The project consists of three segments: Bluetooth module interface for movement of the robotic vehicle and live streaming of the robot POV via Wi-Fi and water pump for sprinkling water. Bluetooth module HC-05 is used for communication as it is cost-effective and has a wider range compared to IR or RF signals. The controlling device is an Android mobile with a Bluetooth app. Bluetooth technology is a de facto standard for small form factor, low-cost, short-range radio links between communication devices. It uses frequency hopping spread spectrum and supports both point-to-point and point-to-multipoint connections. The technology provides up to 720 Kbps data transfer within a range of 10 meters (up to 100 meters with a power boost). The rest of the paper is organized as follows. Implementation and working are explained in section II. Results and Final Product are presented in section III. Concluding remarks are given in section IV.

II. IMPLEMENTATION

In this project, we are using Nano Development board which have amega328PU micro-controller and ESP32 Cam Board and with different components such as HC-05 Bluetooth module L293d motor, water Pump and Battery as a power source. Once we power ‘ON’ the system micro-controller starts and execute the program burned in hex file in project. First, we need to connect Android mobile application with Bluetooth module by going Android settings connect new devices select hc05 module. Once the system is connected LED on hc05 is blinked slowly continuously. Now when we press button Android App system start moving forward direction and when we press the button left or right system turn itself respectively as predefined code in it. To control the

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water pump application, have specific button. ESP32 contact with assigned network and start the video streaming.

With the current specification, up to seven slave devices can be set to communicate with a master radio in one device. This connection of devices (slaves and master) is called a piconet. Several piconets can be linked together to form scatternets which allow communication between other device configurations. HC-05 module is an easy-to-use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup.

Serial port Bluetooth module is fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with complete 2.4GHz radio transceiver and baseband. It uses CSR Blue core 04-External single chip Bluetooth system with CMOS technology and with AFH (Adaptive Frequency Hopping Feature). It has the footprint as small as 12.7mmx27mm.

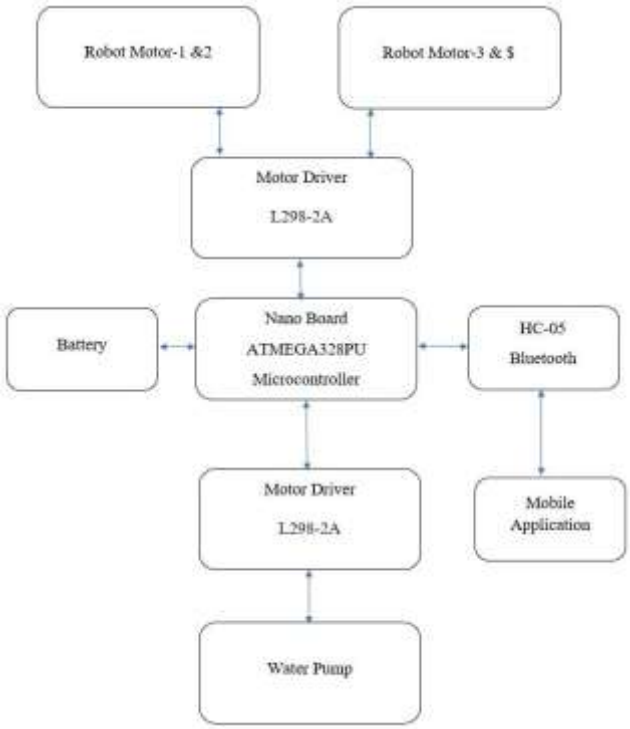

Fig. 1. Block diagram of the Robot.

Some of the software features regarding the HC-05 module is Default Baud rate: 38400, Data bits:8, Stop bit:1, Parity: No parity, Data control has Supported baud rate: 9600, 19200, 38400, 57600, 115200, 230400, 460800. The signals from the android application are passed to the HC-05 parallelly, where this module receives and processes it serially, and passed it to the micro-controller accordingly. The android application downloaded and can be edited the options in it from IOP, along with the background picture in the application. A sample edited application is as shown, here, different control options like forward, left, right, backward and stop are assigned from different number keys available in IOP application by default. We can connect any Bluetooth device which is compatible.

Fig. 2. ESP32 Streaming Block Diagram

III. EXPERIMENT AND RESULT

The fire-fighting robot is designed to be fully controlled by a mobile phone via Bluetooth. The robot was successfully built and programmed to follow the commands received from the mobile phone in real time. The mobile application used to control the robot via Bluetooth was developed in Android Studio. The app includes a simple user interface that allows the user to move the robot in any direction using the phone's touch screen. The app also includes a button to activate the water pump and spray water from the nozzle attached to the robot. The robot was tested in a controlled environment to simulate a fire scenario. The robot was able to navigate through the testing area without any problems. The results of this study demonstrate the feasibility of controlling a fire-fighting robot through a mobile phone via Bluetooth. Overall, this project provides a proof-of-concept for a simple and affordable fire-fighting robot that can be controlled through a mobile phone. This technology has the potential to be further developed and refined to create more sophisticated and effective fire-fighting robots in the future.

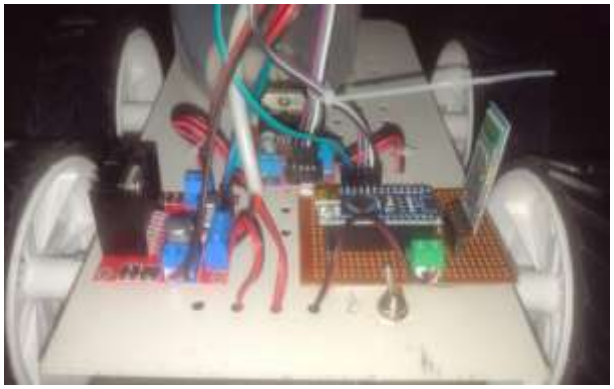

Fig. 3. Circuit Picture of the Robot.

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Fig. 4. Top View of the Robot.

IV.CONCLUSION

The robot is designed to aid firefighters in hazardous situations by detecting and extinguishing fires remotely. Through the use of affordable and readily available components, the robot is a cost-effective solution that can be deployed in a variety of environments. The prototype was able to successfully detect and extinguish fires in various test scenarios while streaming live video to a phone. The live video feed provides real-time situational awareness to the operator, enabling them to make informed decisions and respond quickly to changing circumstances. Moreover, the robot's remote-control system allows for efficient and safe operation in dangerous situations. The inclusion of Bluetooth technology enhances the robot's ability to stream live video to a phone and operate remotely, enabling it to access areas that may be difficult to reach otherwise. Overall, this low-cost firefighting robot has the potential to greatly improve firefighting operations and save lives. With further development and optimization, this technology can be integrated into existing firefighting systems and become an indispensable tool for firefighting professionals.

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