MAZE NAVIGATION SYSTEM

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BONAFIDE CERTIFICATE

Certified that this project report entitled **MAZE NAVIGATION SYSTEM** is a Bonafide work of AD VIKRAM-22BEC1018, JAYANTH BALAN-22BEC1053, ANURAG JOSHI-22BEC1066, SURYA THANGARAJU-22BEC1098, SANDIP MUKHERJEE-22BEC1105, SHIBAM POBI-22BEC1135, ASHISH PUJAPANDA-22BEC1176 who carried out the project work under my supervision and guidance for BECE204L-MICROPROCESSORS AND MICROCONTROLLERS.

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ABSTRACT

This project aims to create an obstacle avoidance rover using an 8051 microcontroller and three infrared sensors. The rover has three infrared sensors strategically positioned to detect obstacles in the front, left, and back directions. The 8051 microcontroller processes sensor data and controls the rover's movement to prevent collisions. The rover chassis is designed to accommodate two 100 RPM motors and four wheels, allowing for omnidirectional movement. The rover navigates its environment autonomously by combining sensor feedback and motor control, demonstrating effective obstacle avoidance. This project applies microcontroller-based robotics to real-world scenarios, including surveillance, exploration, and remote monitoring.

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INTRODUCTION

1.1 OBJECTIVES AND GOALS

To design an Obstacle avoidance rover using 8051 Microcontroller with the following features: -

1)Power Efficient Rover
2) Highly Effective Algorithm
3) Low Manufacturing Cost

1.2 APPLICATIONS

The obstacle avoidance rover, powered by an 8051 microcontroller and infrared sensors, has numerous applications in disaster management, healthcare, education, and rugged terrain exploration. In disaster management, it helps to navigate hazardous areas for search and rescue operations. In healthcare, it efficiently delivers medical supplies to hospitals and disaster areas. As an educational tool, it improves STEM education by teaching robotics and programming concepts. Furthermore, the rover's rugged design enables it to navigate difficult terrain for environmental studies and wildlife monitoring. Its versatility and precision make it indispensable for addressing a wide range of real-world challenges in these domains.

1.3 FEATURES

The obstacle avoidance rover is equipped with an 8051 microcontroller for precise control and three strategically placed infrared sensors for comprehensive obstacle detection. It has two 100 RPM motors powered by an L298 motor driver, allowing for agile movement across a variety of terrains. The rover's sturdy chassis, powered by a 12 Volt lead acetate battery, supports four wheels, allowing for stability and maneuverability. Its autonomous navigation capabilities allow it to detect obstacles in the front, left, and back directions and adjust its path to avoid collisions. The compact design and reliable performance make it ideal for surveillance, exploration, and remote monitoring applications, providing a versatile solution for addressing real-world challenges efficiently and precisely.

Design

2.1 CODE

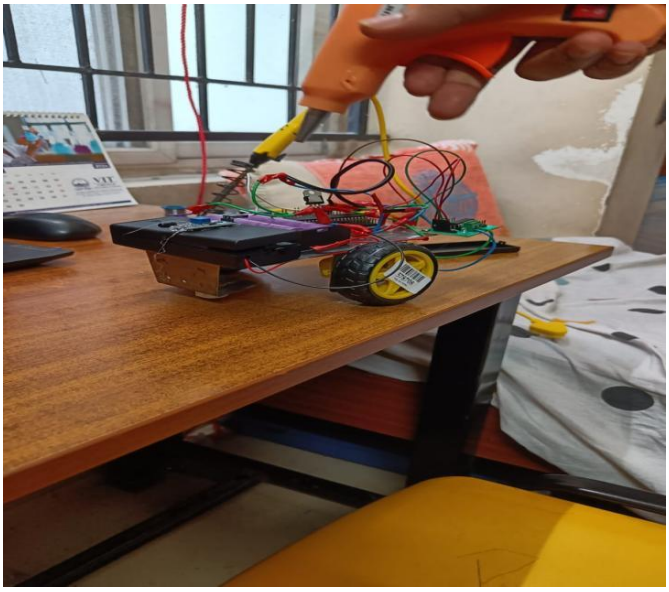
```
#include <reg51.h>

// IR Sensor Definitions
sbit ir1 = P1^0; // Portside Sensor
sbit ir2 = P1^1; // Bow Sensor
sbit ir3 = P1^2; // Starboard Sensor

// Motor Control Definitions
sbit M1a = P3^1; // Motor 1: Input 1
sbit M1b = P3^0; //                  Input 2
sbit M2a = P3^3; // Motor 2: Input 1
sbit M2b = P3^2; //                  Input 2

//Global Variable Definitions
unsigned int i;

//Function Declarations
void delay(unsigned int n);
void movfwd();
void movrev();
void stall();
void turnport();
void turnstar();


void main()
{
    while(1)
        {
            if(ir2)
            {
                movfwd();
            }
            else
            {
                stall();
                movrev();
                delay(1000);

                if(ir1)
                {
```

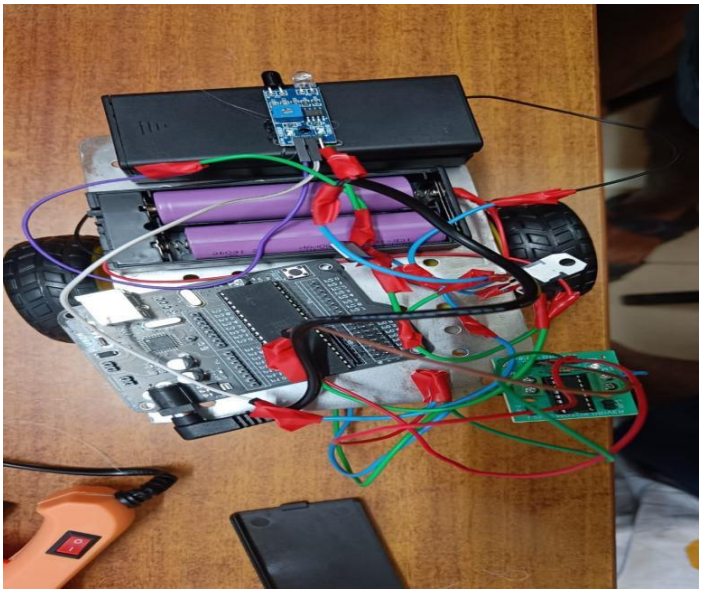
```
                turnport();
            }
            else if(ir3)
            {
                turnstar();
            }

            delay(1000);
        }

        if (!ir2)
        {
            stall();
        }

        if (!ir1)
        {
            turnstar();
        }

        if (!ir3)
        {
            turnport();
        }

        if(ir1 && ir2 && ir3)
        {
            movfwd();
        }

        delay(1);
    }
}


//Function Definitions
void delay(unsigned int n) //(nx1)ms Delay
{
    TMOD = 0x01;

    for(i = 0; i < n; i++)
    {
        TH0 = 0xF8;
        TL0 = 0xCC;

        TF0 = 0;
        TR0 = 1;
        while(!TF0);
        TR0 = 0;
        TF0 = 0;
```

```
    }
}

void movfwd() //Forward
{
    M1a = 1;
    M1b = 0;
    M2a = 1;
    M2b = 0;
}

void movrev() //Reverse
{
    M1a = 0;
    M1b = 1;
    M2a = 0;
    M2b = 1;
}

void turnport() //Turn Portside
{
    M1a = 0;
    M1b = 1;
    M2a = 1;
    M2b = 0;
}

void turnstar() //Turn Starboard
{
    M1a = 1;
    M1b = 0;
    M2a = 0;
    M2b = 1;
}

void stall() //Stop
{
    M1a = 0;
    M1b = 0;
    M2a = 0;
    M2b = 0;
}
```

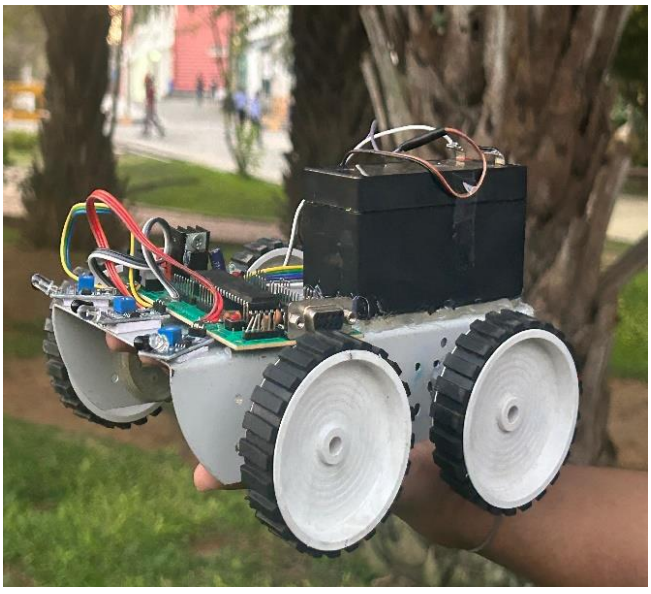
2.2 SNAPSHOTS

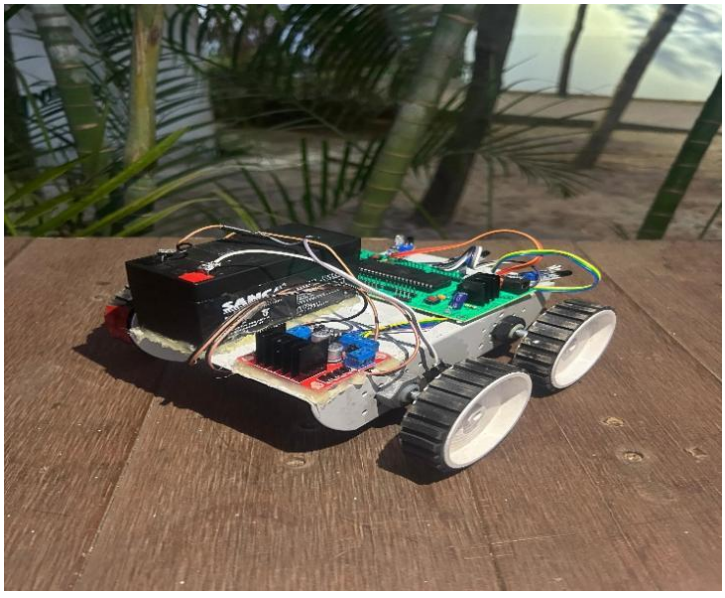
Prototype Model

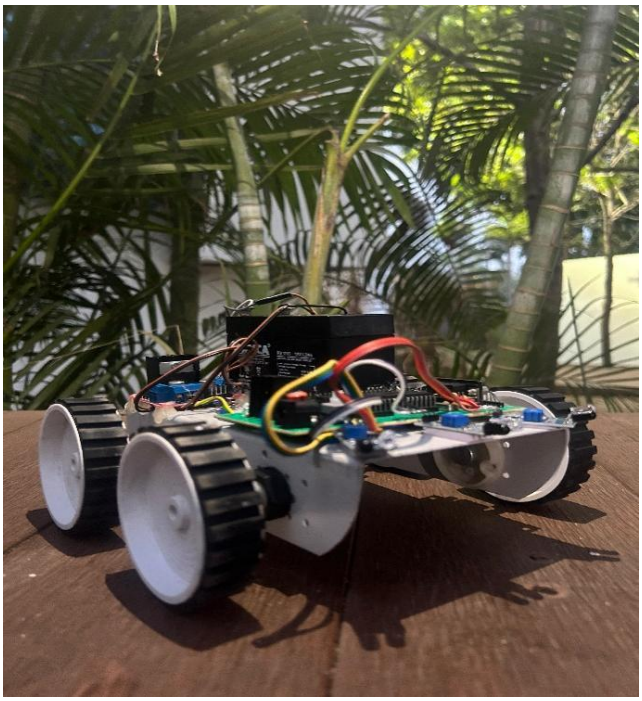


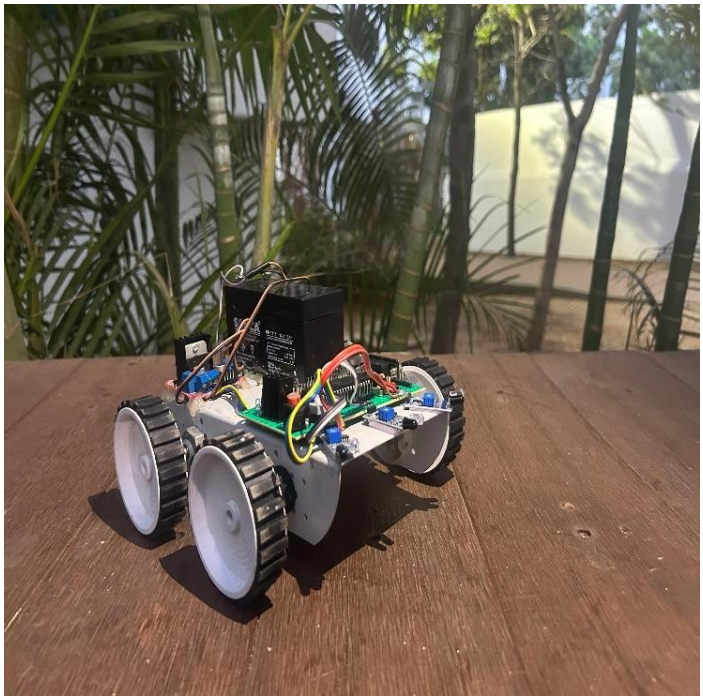


Final Model









2.3 Components

Defective Model

1) LITHIUM ION BATTERY – 4 3.7V lithium-ion battery offers dependable and long-lasting power with a constant 14.8V for a variety of electronic devices and applications.

2) 8051 MICROCONTROLLER ARYABHATTA MODEL

3) IR SENSOR – The 1 IR sensor detects infrared radiation, allowing precise proximity detection in a variety of applications.

4) SMALL TRI-SUPPORT CHASSIS, 2-WHEELS, 2-B0 MOTOR and 1-CASTER WHEEL

5) L293D MOTOR DRIVER – The L293D motor driver is a versatile integrated circuit that allows bidirectional control of DC motors and simple interfacing with microcontrollers for robotics and automation projects.

6) LITHIUM-ION BATTERY HOLDER

7) 12V VOLTAGE REGULATOR LM7812 – The 12V voltage regulator provides a stable and reliable power supply for low-voltage electronic components and circuits.

8) 5V VOLTAGE REGULATOR LM7805 – The 5V voltage regulator generates a steady and regulated 5-volt output that can be used to power a variety of electronic devices and components.

Final Model

1) 12V LEAD ACETATE BATTERY – 12V lead acetate rechargeable battery provides a dependable power source with long-term performance for a wide range of applications, including automotive and industrial use.

2) AT89S52 MICROCONTROLLER AND DEVELOPMENT BOARD

3) L298 MOTOR DRIVE – The L298 motor driver is a dual H-bridge integrated circuit that provides reliable control for DC motors, making it ideal for robotics and mechatronics applications.

4) DC MOTOR – The 100 RPM DC motor rotates at 100 revolutions per minute with a high torque, making it ideal for applications that require moderate weights and rotational speeds, such as robotics, automation, and hobby projects.

5) 4-WHEEL MOUNT CHASSIS, WHEELS

6) IR Sensors - The rover's 3 IR sensors enables it to detect obstacles in the front, left, and right directions, allowing for comprehensive obstacle avoidance capabilities during navigation.

7) SWITCH- A small switch is attached for easy operation and for power on and off purpose.

CONCLUSION

RESULT:

The project produced a fully functional obstacle avoidance rover powered by an 8051 microcontroller, three infrared sensors, two 100 RPM motors, and L298 motor drivers. The rover has a sturdy chassis and is powered by a 12-volt lead acetate battery, which allows it to navigate reliably and avoid obstacles in its path. This project demonstrates the successful integration of hardware components and software algorithms to create a versatile and efficient autonomous rover suitable for a wide range of real-world applications, including surveillance, exploration, and remote sensing.

CONCLUSION:

To summarize, the successful development and implementation of the obstacle avoidance rover using an 8051 microcontroller, IR sensors, 100 RPM motors, and other critical components represents a significant milestone in autonomous robotics. The rover's precise design and integration result in reliable navigation and obstacle avoidance capabilities, demonstrating the potential of microcontroller-based systems in addressing real-world challenges. The project emphasizes the importance of interdisciplinary collaboration, systematic testing, and continuous refinement in maximizing functionality and adaptability for a variety of applications. Moving forward, further improvements may open up new opportunities for leveraging autonomous robotics in a variety of fields, emphasizing the importance of innovation and technological advancement in shaping the future.

INFERENCES:

The obstacle avoidance rover project demonstrates the effectiveness of infrared sensors in detecting obstacles and precise motor control in avoiding collisions. The rover, powered by an 8051 microcontroller, demonstrates the integration of hardware components such as motors, sensors, and motor drivers to enable autonomous navigation. The use of a 12V lead acetate battery ensures continuous operation, emphasizing the importance of power management. Practical applications for surveillance, exploration, and remote monitoring demonstrate the rover's versatility. This project encourages further robotics and mechatronics innovation by providing insights into the development of autonomous systems for real-world applications such as disaster management, healthcare, and education.

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