1.Abstract:

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| This project report describes the design, development, and testing of a Bluetooth-controlled Mini soccer bot. The aim of this project was to create a small-scale autonomous robot that can play soccer and be controlled wirelessly using Bluetooth technology.  The Mini soccer bot was designed using a combination of off-the-shelf components, including motor drivers, sensors, and an Arduino Nano microcontroller. The robot was programmed to respond to various commands sent via Bluetooth from a mobile phone application. The Bluetooth connectivity allowed for easy and intuitive control of the robot's movements, making it easy for users to play soccer with the robot.  The final product was tested in a simulated soccer field, where it was able to accurately navigate through obstacles and kick the soccer ball. The Mini soccer bot project represents a valuable opportunity to explore the cutting-edge of robotics and AI and to push the boundaries of what is possible in the field of sports technology. |

2.Introduction:

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| Mini soccer bot is a robotic project that involves the design, development, and construction of a small-scale autonomous robot that can play soccer. The project aims to integrate various technologies such as artificial intelligence, machine learning, and robotics to create a robotic platform that can function in a dynamic and unpredictable environment.  The Mini soccer bot project addresses the global topics of robotics, automation, and artificial intelligence. Robotics and automation have become increasingly important in recent years due to their potential to increase efficiency and productivity in various industries.  The background of the Mini soccer bot project can be traced back to the development of robotic sports, which have gained popularity in recent years. Robotic sports competitions such as the “RoboCup” have become platforms for researchers and developers to showcase their skills and innovations in robotics and AI.  The Mini soccer bot project is important because it has various real-life applications, including industrial, medical, and assistive uses. In the industrial setting, robots can increase efficiency, reduce labor costs, and improve product quality. In the medical field, robots can assist with surgical procedures and rehabilitation therapy. Assistive robots can also help individuals with disabilities to perform daily tasks and improve their quality of life. |

3.Project Complication:

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| **Hardware:** One of the important aspect of this project was to make the as small as possible, so the size of the bot is 15 by 15. the following hardware are used in this bot:   1. Arduino Nano 2. Motor Driver l298N 3. 900 Mah-Lipo Battery 4. Hc-05 Bluetooth Module 5. Wheel 16mm 4x 6. 300 RPM N20 Gear Dc motor 7. Mg 90 Servo 8. Spacer Hex   The L298N motor driver is dual H-bridge driver. It has two control inputs for each H-bridge, allowing it to drive the motors forward, backward, or break them to a stop. The H-bridge design also enables the motor to be controlled with pulse width modulation signals, which can vary the speed of the motor by varying the duty cycle of the input signal. L298N motor driver has high current capacity. It can handle a continuous current of up to 2 amps per channel, with a peak current of up to 3 amps per channel. This makes it suitable for driving high-power DC motors, such as those used in robotics, automation, and other similar applications.  The Arduino Nano is used in our projects “Mini soccer bot”. It serves as the brain of the robot, controlling its various functions and movements.  In Mini soccer bot, the Arduino Nano is typically connected to several sensors and actuators, such as motors, sensors, and communication modules. The actuators can include motor drivers that control the movement of the robot.  The Arduino Nano runs a program, often written in the Arduino programming language, which defines how the robot should behave in different situations. The Arduino Nano communicates with these sensors and actuators through various input and output pins, which are used to send and receive signals between the microcontroller and the other components. These pins can be programmed to perform a variety of different functions, depending on the needs of the project.  Overall, the Arduino Nano plays a critical role in the operation of Mini soccer bot. It provides the intelligence and control necessary for the robot to function autonomously, enabling it to navigate the playing field, detect the ball, and make decisions about how to move and interact with its environment.  **Circuit Diagram:**  **Diagram  Description automatically generated**  Budget Information:   |  |  |  |  | | --- | --- | --- | --- | | ***SL*** | ***Component*** | ***Quantity*** | ***Unit Cost (BDT)*** | | 1 | Arduino Nano | 1 | 950 BDT | | 2 | L298N DC Motor Driver | 1 | 150 BDT | | 3 | Wheel 16mm 4x |  | 230 BDT | |  | Mg 90 Servo |  |  | |  | Spacer Hex |  |  | | 4 | HC05 Bluetooth Module | 1 | 250 BDT | | 5 | Motors & 900 Mah-Lipo Battery | 4,4 | 900BDT, 320BDT | | **Total Cost (BDT) =** | | | |   **Software:**  **This is Flowchart for our code:**    **The algorithm for the Arduino code is as follows:**   1. Initialize the Servo motor on pin 12 and set its initial position to 90 degrees. 2. Set up the L298 motor driver pins as output. 3. Wait for one second to allow everything to stabilize. 4. Enter the main loop. 5. If serial data is available, read it and store it in the bt\_data variable. If the data is greater than 20, set the Speed variable to the new value. 6. Set the speed of both motors using the analogWrite() function with the value of Speed as the duty cycle. 7. Check the value of bt\_data and call the appropriate function based on its value. 8. The function for each possible value of bt\_data is as follows:    * 1: Set both motors to go forward.    * 2: Set both motors to go backward.    * 3: Turn the robot to the right by running the left motor forward and the right motor backward.    * 4: Turn the robot to the left by running the right motor forward and the left motor backward.    * 5: Stop both motors.    * 6: Turn the robot left by running the right motor forward and the left motor backward, then stop the robot after a delay of 400 ms.    * 7: Turn the robot right by running the left motor forward and the right motor backward, then stop the robot after a delay of 400 ms.    * 8: Set the Servo motor to the 0-degree position.    * 9: Set the Servo motor to the 180-degree position. 9. Wait for 30 ms before starting the loop again.   The following functions and library are used in this code:  **Library:**   * **Servo.h**: This is a library used to control servo motors. * **Servo motor\_1**: This creates an instance of the Servo class. * **enA**, **in1**, **in2**, **in3**, **in4**, **enB**: These are pins used to control the L298 motor driver. * **servo1**: This variable stores the initial position of the servo motor. * **bt\_data**: This variable stores the data received over serial communication. * **Speed**: This variable stores the speed of the DC motor.   **Functions**:   * **setup()**: This is a function that is called once when the program starts. It initializes the serial communication, sets the pins as inputs or outputs, and sets the initial position of the servo motor. * **loop()**: This is a function that is called repeatedly after the **setup()** function. It reads the data sent over serial communication, sets the speed of the DC motors, and calls the appropriate function based on the received data. * **forword()**, **backword()**, **turnRight()**, **turnLeft()**, **Stop()**: These are functions that control the direction of the DC motors. They set the appropriate pins high or low to control the direction of the motors. |
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4.Recommendations:

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| One possible future scenario for the Mini soccer bot project is the continued development and refinement of the technology, leading to even more sophisticated and capable soccer-playing robots. As AI and robotics continue to advance, it is likely that Mini soccer bot projects will benefit from improved sensors, more advanced algorithms, and other technical innovations that will allow the robots to perform even better on the playing field.  In order to achieve this future scenario, there are several steps that can be taken to improve the Mini soccer bot project. One is the use of accurate and reliable sensors that can help the robots detect the ball and navigate the playing field more effectively. This could involve the use of more advanced computer vision techniques, such as object detection and tracking, or the development of new types of sensors that can better detect the movement of the ball and other objects.  Another improvement is the software algorithms that control the behavior of the robots. By refining and optimizing these algorithms, it may be possible to create robots that are more efficient and effective at playing soccer.  **In terms of limitations and problems faced during the Mini soccer bot project**: one common issue is the difficulty of accurately controlling the movements of the robots, especially in a fast-paced and dynamic environment like a soccer game. As Bluetooth module was used in this bot, there was a connection problem between the controller and the bot.  Another technical challenge was the limited power supply as the batteries did not stay charged for long. Other problem that we faced was regarding the code, while uploading the code we burnt our Arduino. Also, as the Arduino has limited memory, it is difficult to implement complex algorithms. We also faced some financial problems as our Arduino was burnt otherwise if we had a group of five or six the cost would have been a little less , alternatively, we could have used more advanced equipment.  Overall, the Mini soccer bot project represents an exciting opportunity to explore the intersection of robotics, AI, and sports. While there are certainly technical challenges and limitations to be overcome, the potential benefits of this technology are significant, including increased efficiency, improved quality of life, and new opportunities for innovation and creativity. |

5.Conclusion:

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| In conclusion, the Mini soccer bot project is an exciting endeavor and a fun project that brings together the fields of robotics, AI, and sports. The project involves designing and developing small-scale autonomous robots that can play soccer, utilizing various technologies such as motor controllers, sensors, and microcontrollers like the Arduino Nano.  Throughout the course of the project, several technical challenges and limitations have been encountered, such as accurately controlling the movements of the robots and dealing with limited processing power and memory. However, with careful planning and development, these challenges can be overcome, and the Mini soccer bot project has the potential to revolutionize the way we think about sports, robotics, and automation. |