WORLD ROBOT OLYMPIAD

THE SHADOW

Road plan report

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I. Planout

To construct an efficient and fully functional car, a well-thought-out plan is essential. This plan includes a comprehensive strategy, defining the car's goal, and concluding the optimal strategy to achieve it.

a) Strategy

A detailed strategy outlines the necessary steps and considerations for building the car. This strategy will ensure all components work harmoniously, resulting in a smooth and efficient build process.

b) Set Car's Goal

The car's goal is to achieve autonomous navigation using sensors and a motor control system. This goal will guide all design and construction decisions.

c) Conclude Optimal Strategy

Determining the best strategy involves analyzing different approaches and selecting the one that meets the goals most effectively. This includes considerations for hardware, software, and overall design.

d) Game Rules

Understanding the game rules is crucial to ensure the car complies with all requirements and performs optimally in the competition.

e) Read Game Rules

Thoroughly reading and understanding the game rules will help in formulating a strategy that adheres to the competition's guidelines.

f) Form a Rule Summary

A summarized version of the game rules provides a quick reference to ensure all aspects of the car's design and operation comply with the competition's standards.

g) Understand and Apply

Applying the game rules effectively ensures the car's performance is within the acceptable limits and maximizes its chances of success.

h) Build and Hardware Selections

Selecting the right hardware is fundamental to the car's performance. This section outlines the building materials, steering mechanism, drive system, computing unit, and layout.

i) Building Material

Choosing durable and lightweight materials is essential for the car's structure. Mblock parts and prototype boards will be used for this purpose.

j) Steering Mechanism

A reliable steering mechanism, including a black 180° servo, is crucial for precise control of the car's direction.

k) Drive System

The drive system will consist of 2 yellow DC motors controlled by a BTS7960 motor driver, providing the necessary power and control.

l) Computing Unit and Layout

An Arduino Nano will serve as the central computing unit, with all components connected to it according to a well-planned layout.

m) Software and Algorithms

Software and algorithms will control the car's movement and sensor processing. The programming language, algorithm flow, and necessary libraries will be detailed.

n) Programming Language

The car's software will be programmed in C++, utilizing the Arduino IDE for development.

o) Algorithm Flow

The algorithm flow will include functions for steering, movement, and sensor data processing, ensuring smooth and efficient operation.

II. Hardware

Selecting components that match the goals required is essential for the car's performance. This section details the specific components chosen for the build.

a) Select Components that Match the Goals Required

Components will be selected based on their compatibility and ability to meet the project's requirements.

b) Arduino Nano

The Arduino Nano will act as the main control unit, managing all inputs and outputs.

c) BTS7960 Motor Driver

The BTS7960 motor driver will control the motors, ensuring precise and efficient movement.

d) 2 Yellow DC Motors

Two yellow DC motors will provide the necessary propulsion for the car.

e) 4 Ultrasonic Sensors

Four ultrasonic sensors will be used for obstacle detection and avoidance, enhancing the car's autonomous navigation capabilities.

f) Black 180° Servo

A black 180° servo will be used for steering, providing accurate and responsive control.

g) Mblock Parts

Mblock parts will be utilized for the car's structural framework, offering versatility and ease of assembly.

h) Prototype Board

A prototype board will be used for organizing and connecting the electronic components.

i) Battery: Lithium Ion 3.7V (3 pcs)

Three lithium-ion batteries will power the car, ensuring sufficient energy for all components.

j) CmU Pixy Cam 5

The CmU Pixy Cam 5 will provide visual data for the car's navigation system.

III. Hardware Build

The hardware build involves assembling all components, making sure they fit together seamlessly, and forming a sturdy and functional car.

a) Use Mblock Strips to Form Steering Mounts

Mblock strips will be used to create mounts for the steering mechanism, ensuring stability and precision.

b) Form a Frame for the Components

A robust frame will be constructed to hold all components securely in place.

c) Use Mblock Brackets for Mounting Sensors and Motors

Mblock brackets will be employed to mount the sensors and motors, providing secure and adjustable fittings.

d) Apply Steering System

The steering system will be installed and calibrated for accurate control.

e) Electrical Connections and Schematic

A detailed schematic will be created for the electrical connections, ensuring all components are correctly wired.

f) Connect All Components to Respective Pins on Arduino Nano

Each component will be connected to its designated pin on the Arduino Nano, following the schematic.

g) Set a Schematic for Wiring

The schematic will serve as a blueprint for all wiring, ensuring clarity and precision.

h) Conclude Final Wiring Diagram

The final wiring diagram will be completed, providing a clear and accurate representation of all connections.

i) Wiring Connections on Prototype Board

Wiring connections will be organized on the prototype board for easy access and troubleshooting.

j) Cut Wires to Given Size

Wires will be cut to the appropriate length, ensuring neat and efficient connections.

k) Layout All Pins on Perf Board

All pins will be laid out on the perf board in an organized manner, facilitating easy connections and adjustments.

l) Solder All Connections and Pins

All connections and pins will be soldered securely, ensuring reliable electrical connections.

m) Check for Fault Connections

Each connection will be checked for faults, ensuring all components are correctly wired.

n) Test with Sensors

The sensors will be tested to verify their accuracy and functionality.

o) Debug and Test Components

All components will be thoroughly tested and debugged to ensure they function correctly.

p) Test Perf Board with All Components

The perf board will be tested with all components connected, verifying overall functionality.

q) Test Ultrasonic Sensor Accuracy

The accuracy of the ultrasonic sensors will be tested, ensuring reliable obstacle detection.

r) Test Motor Driver Functionality

The motor driver will be tested to ensure it can control the motors effectively.

IV. Gather All Parts and Construct Final Car

All parts will be gathered, and the final car will be constructed, integrating all components seamlessly.

a) Assemble Perf, Frame, Motors, and Driver

The perf board, frame, motors, and driver will be assembled into a cohesive unit.

b) Mount Sensors and Calibrate Servo for Steering

Sensors will be mounted, and the servo will be calibrated for optimal steering angles.

c) Find Optimal Steering Angles

Optimal steering angles will be determined to ensure precise control.

d) Test Fully Built Car

The fully built car will be tested to ensure all functionalities work as intended.

e) Test Fully Built Car with Its Functionalities

All functionalities of the fully built car will be tested, including movement, steering, and sensor data processing.

V. Test Software and Hardware Together

The software and hardware will be tested together to ensure seamless integration.

A. Find Turning Angles and Delays

Optimal turning angles and delays will be determined to enhance performance.

VI. Software

The software development process involves setting up the environment, writing code, and ensuring the software interacts correctly with the hardware.

a) Envi0ronment and Setup

The software development environment will be set up, using the Arduino IDE and C++ programming language.

b) Arduino IDE

The Arduino IDE will be used for writing, compiling, and uploading code to the Arduino Nano.

c) C++ Coding Language

The car's software will be written in C++, utilizing its powerful features and libraries.

d) C++ Servo Library

The C++ Servo library will be used to control the servo motor, providing precise steering control.

VII. Code Basis

The code will be structured to include functions for steering, movement, and sensor data processing.

a) Assign Functions for

Functions will be assigned for specific actions such as 90° turns, right and left adjustments, and forward movement.

b) 90° Turn to the Right

A function will be written to execute a 90° turn to the right.

c) 90° Turn to the Left

A function will be written to execute a 90° turn to the left.

d) Right Adjust

A function will be written to make slight adjustments to the right.

e) Left Adjust

A function will be written to make slight adjustments to the left.

f) Forward

A function will be written to move the car forward.

g) Sensor Values

Functions will be written to process and utilize sensor values.

h) Ultrasonic_Calculate

A function will be written to calculate distances using ultrasonic sensors.

i) Set Up

The setup process will involve declaring pins, aligning servos, and initializing sensors.

j) Declare

Pins for the ultrasonic sensors and servos will be declared in the code.

k) Ultrasonic Pins

The ultrasonic sensor pins will be defined and initialized.

l) Servo Pins

The servo pins will be defined and initialized.

VIII. Setup

The setup function will configure all pins and components for operation.

a) Ultrasonic Pins

The ultrasonic sensor pins will be set up for accurate distance measurements.

b) Servo Alignment

c) Get Values

Functions will be written to retrieve values from the sensors.

d) Loop

The main loop will check for various cases and execute corresponding actions.

IX. Check for Any Cases

The code will check for different scenarios and respond appropriately.

a) Place Whatever You Think Is Good Right Here

Additional necessary steps or functions will be added as needed.

b) Testing

Thorough testing will ensure all components and code function correctly.

c) Check Connections

All electrical connections will be checked for accuracy and reliability.

d) Check Ultrasonic Accuracy

The accuracy of the ultrasonic sensors will be verified.

e) Check Code Functionality

The functionality of the code will be tested to ensure it performs as expected.

f) Check for Missing Cases and Conditions

The code will be reviewed to identify and address any missing cases or conditions.

g) Find Faults and Code Issues & Bugs (Skill Issues)

Any faults or issues in the code will be identified and fixed.

h) Test Delays and Angles

Delays and angles will be tested to ensure smooth operation.

i) Test for Forward Alignment

The car's forward alignment will be tested and adjusted as needed.

j) Fix Steering Issues

Any issues with the steering system will be identified and fixed.

k) Fix Code Logic

The code logic will be reviewed and refined for optimal performance.

l) Try New Algorithm and Sequence

New algorithms and sequences will be tested to find the most effective solution.

m) Write Summary/Report

A detailed summary and report will be written, documenting the entire process.

n) Organize a Full Word Document

A comprehensive Word document will be created, detailing all major steps and findings.

o) Write Down All Major and Main Steps

All major and main steps will be documented in the report.

p) Form Final Report by Editing and Printing

The final report will be edited for clarity and accuracy before printing.

q) Camera Testing

The camera system will be tested to ensure it provides accurate visual data.

r) Before Competition Day Prep

Final preparations will be made to ensure the car is ready for the competition.