



e-Yantra Robotics Competition

e-YRC#211-WD

Team leader name	SOUMYADIP GHOSH
College	JADAVPUR UNIVERSITY, KOLKATA
Email	soumyadip93@gmail.com
Theme assigned	WEEDING ROBOT
Date	23/12/2013

Scope

(5)

State the scope of the theme assigned to you.

The economy of India is heavily dependent on agriculture. India ranks 2nd in the world in farm output (Source – Wikipedia) with agriculture contributing about 20% of GDP and employing 51% of the total workforce. Recently, the phenomenon of urban agriculture is also flourishing, with people opting to grow small-scale crops and flowers in rooftops and climate-controlled greenhouses. For a long time, Indian farming relied on manual processes but due to ever-increasing demand, use of automation is very much the need of the hour.

So the weeding robot aims to identify and uproot weeds automatically without disturbing the desirable plants. Studies have also shown that the amount of pesticides for killing pests and weeds can be reduced to very few grams of active ingredients which applied with high precision which can be implemented by these robots.

Building Modules

(5)

Identify the major building blocks in the robotic system that needs to be designed for your theme.

- 1) Power supply (auxiliary or battery power)
- 2) Processing unit
 - Atmega2560 as master
 - Atmega8 as slave

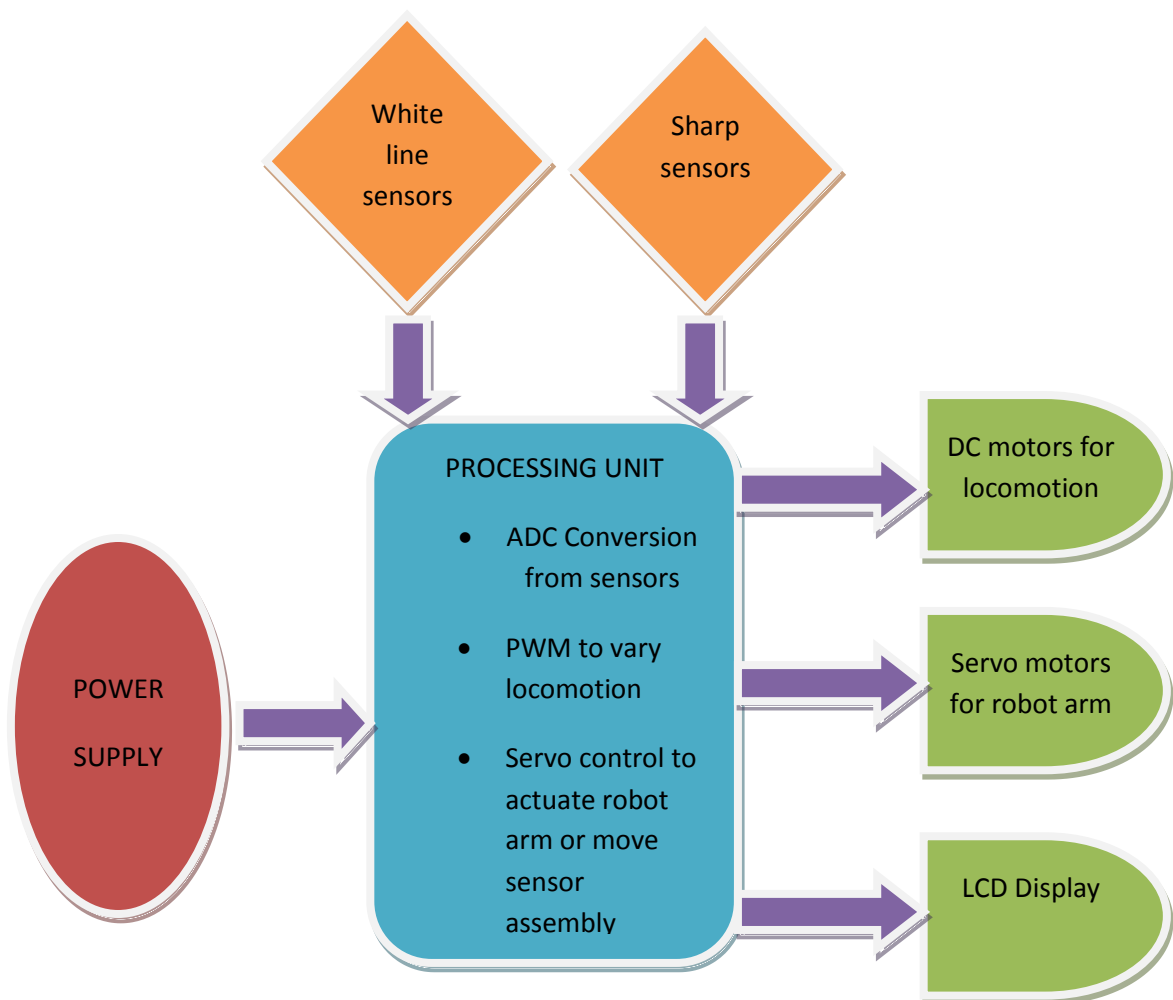
3) Sensors

- Sharp and analog IR proximity sensors for weed identification
- White line sensors for locomotion

4) Actuators

- left and right motor for locomotion
- robot arm with end effectors using servo motors for weed uprooting

5) Display (optional, can be used to display current status of robot which can help debugging processes)



MAJOR BUILDING BLOCKS REQUIRED FOR WEEDING THEME

Actuators

(10)

List all the actuators currently present on FIREBIRD V robot and also the essential actuators required for designing the robotic system in your theme.

Actuators currently present in FIREBIRD V robot:-

- Two 75 RPM DC geared motors powered by L293D motor driver.

Additional actuators required for weeding theme

- Robot arm to be built using servo motors

Explain the mechanism for controlling the actuators on your robot.

- The **75 RPM DC motors** are controlled via L293D dual motor driver ICs which can provide upto 600 mA of current to each motor. L293D's direction control pins are used to change the direction of the motor while velocity control is done using PWM. Pins 0 & 1 and pins 2 & 3 of port A are reserved for left and right motor direction controls respectively. Pins 3 and 4 of port L are used for PWM for left and right motors respectively. Position encoders are implemented along with the motors to give position (and velocity) feedback to the microcontroller. Optical encoders MOC7811 are connected with pins 4 and 5 of port E to generate the external interrupts for position encoding.
- The **robot arm** is built using a mechanical assembly and controlled by servo motors which are connected to servo connectors S1, S2 or S3. Each of these servo connectors are controlled by pin 24, 25 & 26 of Atmega2560 respectively. Power for the servo motor is drawn from the 5 V servo supply voltage regulator. A combination of motor movements will actuate the robot arm accordingly.

Environment sensing

(10)

Explain the functioning of environment sensing technique used by FIREBIRD V robot in your theme.

- FOR WEEDING
 - Sharp sensors – These sensors are used for accurate long distance measurement. We intend to use the 2 sharp sensors provided to distinguish between a healthy plant and weed on the basis of difference in height.

Though the IR sensors provided can be used to sense small distances, it is highly unlikely that they can be used in our theme because the distance from the centre of the black line path to the plant and weeds is about 30 cm, much beyond the range of IR sensors.

- **FOR LOCOMOTION**

- White line sensors – They are used to detect the presence of white line on the surface of the arena. It is used to make the weeding robot follow the specified path in the arena.

Power Management

(5)

Explain the power management system required for a robot in general and for FIREBIRD V robot in particular.

For any robot in general, there must have a stabilized power supply so that the microcontroller and other devices can function smoothly. If too much harmonics or fluctuations are present, offset voltages may arise resulting in unwanted consequences.

FIREBIRD V has a robust power supply comprising of two modes – Auxiliary power (220 V AC supply) or Battery power (NiMH batteries). The auxiliary supply provides 12 V, 1 A regulated supply. In battery mode, maximum of 2 A current can be utilized while auxiliary supply ensures maximum of 1 A.

For weeding robot theme, we intend to use the battery mode of power supply so that the robot can navigate freely. Also, battery mode can provide higher current than auxiliary mode.

Navigation Scheme

(10)

Explain in brief the basic navigation technique for path traversal in the arena. Explain the concept and list the components required for basic navigation.

The robot follows the black line path using the white line sensors (applying inverse logic). Two sharp sensors installed on left as well as right sides of the robot continuously check for obstacles. If detected, the sensor checks if the obstacle is a weed or a healthy plant. This decision is made on the basis of the difference in height. Once the obstacle is classified as a weed, the robot activates the arm using servo motors to uproot the weed. The arm then dumps the weed temporarily in a container on the robot and the process of uprooting weeds

continues. When the robot arrives at the corners where the deposition zones are located, it deposits all the weeds collected. This navigation scheme is just indicative and further changes may be done in due course of time.

Challenges

(5)

What are the major challenges that you can anticipate in addressing this theme?

- Only 2 sharp sensors are provided and IR sensors are not suitable for the required range. So meticulous arrangement for sensing is required.
- Differentiating between weeds and healthy plants.
- Design of the robot arm using servo motors.
- The algorithm for uprooting weeds from troughs and dumping them in deposition zones in minimum time.