Design and Development of Dry Leaf Recycler and Compost Depositing System

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ABSTRACT

In many of the green stations, dried leaves are falling down in large amount per day. usually these leaves were deposited in particular places or they burn these leaves into ashes, this will leads to the release of green house gases. To overcome these problems we have an idea of dry leaf recycler. This is an eco friendly machine, this will automatically collects the leaves from the ground, grind it to the fine powder and deposit under the trees, such that the decomposition process takes place must faster and it will act as an natural fertilizer for the trees. we may also add an external fertilizers to the plants.

Keywords: PLC controller, IR sensor, recycler, fertilizer.

I. INTRODUCTION

A recycling is the process of reusing the waste dried leaves falling from trees into a useful fertilizer in a green station. A recycler will automatically collect the leaves and grind the leaves into a fine particles using universal dc motor. The blower is used to collect the fallen leaves from the ground, such that the problem of disposal of dried leaves will get reduces. the another problem of release of greenhouse gases like carbon monoxide will get reduced. This recycler will reduce the time of sweeping in green stations and the decomposition process of dried leaves will take place faster[17,15]. This recycled leaves will act as a natural fertilizer for trees. Generally, the living organisms waste and dried fallen leaves will act as fertilizer for trees, by converting it into fine powder it will helps in fast absorption of nutrients.

II. BLOCK DIAGRAM AND HARDWARE

The block diagram will represent the hardware components used in the recycler .it also describes the number of input and output connected to the PLC controller.

Given below is a list of hardware components that are being used in hardware demo model. They are enumerated as

1. Power Supply Board (5v 12v and 24v)
2. Transformer (24v 1amp step down)
3. Bridge rectifier
4. Relay(24v)
5. Rs232
6. Rack and pinion
7. Dc motor(12v)
8. Proximity sensor(24v)
9. Blower setup(230v)
10. PLC controller(24v)

The process and purpose of each and every component used in the recycler is explained below
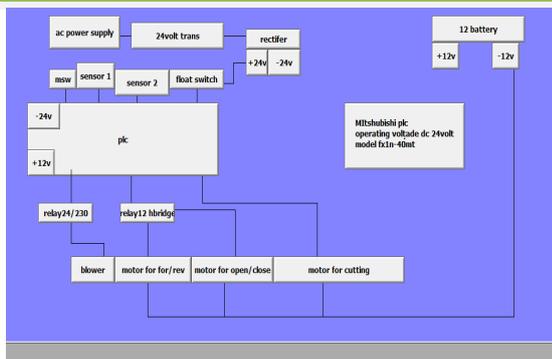
Figure 1:The block diagram and hardware used

1. POWER SUPPLY BOARD

The power supply board is a switched mode power supply which converts 230 volt ac supply into required 24volt(PLC), 5volt(IR sensor) using transformer, bridge rectifier, filter.

2. TRANSFORMER

Electrical power transformer is a static device which transforms electrical energy from one circuit to another by mutual induction between two windings. the transformer is used here is to stepdown 230v supply to 24v supply which is required for proximity sensors, relay, H- bridge circuit and PLC controller.

3. BRIDGE RECTIFIER

The bridge rectifier is connected at the output of transformer to convert the 240v ac supply from transformer into 24v dc supply.The bridge rectifier is followed by the regulator and filter to maintain the 24vdc constantly and to remove harmonics from the output.

4. RELAY

Relay is used for H-bridge circuit(forward and reverse movement of rack and pinion).The relay is also used for giving tripping signal to the blower setup. The relay are also connected in series in with NPN proximity sensor to get positive output required for PLC controller.

5. RACK AND PINION

Rack and pinion is used for opening and closing of bottom hole to deposit the fertilizer under the trees. The PLC controller will send the signal to the H-bridge relay circuit.

6. PLC CONTROLLER

The MITSHUBSHI programmable controller is a packaged controller containing a power supply, input circuits, output circuits, and a processor. The controller will be available in 10 I/O, 18 I/O and 32 I/O configurations, as well as an analog version with 20 discrete I/O and 5 analog I/O.The

PLC controller is used to control the entire process of collecting fertilizers, grinding fertilizers and depositing fertilizers under trees. This contain 18 input and 18 output, the mitshubshi PLC controller is used in this eco-friendly machine. The PLC controller operates at 24v dc supply, the input to the PLC controller should be 24v and the output from the plc controller also 24v dc output.

7. RS232

The RS232 is an serial communication cable used for connecting personal computer and plc controller. This cable is used to feed program from the pc to the controller. The RS232 has 25 pin D connector.

8. DC MOTOR

The DC motor is used for moving the recycler by connecting wheel at the shaft of the motor. The 12v dc motor is supplied from 12v battery setup. The dc motor supply will be reversed to reverse the direction of rotation of wheel.

9. PROXIMITY SENSOR

Proximity sensor is connected at the bottom part, nearer to the blower mouth. such that the problem due to injection of metal particles into the blower will be removed. The another proximity is used for identification of trees by fixing the small metal parts sat certain height of the trees.

10. BLOWER SETUP

The High vacuum blower is used for absorbing the dried leaves from the ground. The blower motor has a rotating speed of 13000 rpm per second.

III. PLC PROGRAMMING SOFTWARE

1. GX DEVELOPER

GX Developer is the basic controller programming supporting Q Process, QS Safety, and legacy controllers like the AnS, QnA, and A700 VFD with built-in PLC. It is also compatible with current Iq Platform / Q, L, and FX Series controller offering. This software is used for programming as well as configuration of communication and intelligent automations. The PLC controller will accepts ladder logics[12,7].

2. LADDER LOGICS:
Ladder diagrams (sometimes called "ladder logic") are a type of electrical notation frequently used to explain how electromechanical switches and relays are interconnected.

- The two vertical lines are called "rails" it will get attach to opposite poles of a power supply, usually 120 volts AC. line1 designates the "hot" AC wire and line2 the "neutral" conductor.
- Horizontal lines in a ladder diagram are called "rungs," each one representing a unique parallel circuit branch between the poles of the supply.
- Typically, wires in control systems are marked in numbers and letters for identification. The rule is all permanently connected points must bear the same label.
- —[ ]— Normally open contact, closed whenever its corresponding coil or an input which controls is get energized.
- —[\]— Normally closed contact, closed whenever its corresponding coil or an input which controls is not energized.
- Rung Output: Actuators (coils)
- —( )— Normally inactive coil, energized whenever its rung was closed.
- —(\)— Normally active coil, energized whenever its rung was opened.

IV. FERTLIZERS

Usually the dried leaves itself act as a natural fertilizer [3,6]for the trees. it may takes long time to decompose the dried leaves, so these leaves were grinded into fine parts, such that it will decompose in a short period .the dried leaves of many plants and trees will combinable act as an good fertilizer[8,6]. These will be used in agricultural fields for producing own natural fertilizer

TABLE 1

FRESH LEAVES	DRIED LEAVES
4 times the vitamin of carrots	10 times the vitamin A of carrots
7 times the vitamin C of oranges	½ the vitamin C of oranges
4 times the calcium of milk	17 times the calcium of milk
3 times the potassium of bananas	15 times the potassium of bananas
¾ the iron of spinach	25 times the iron of spinach
2 times the potassium of yoghurt	9 times the protein of yoghurt

1. *MICROORGANISMS NEEDED FOR PLANT GROWTH*

Micro-organisms include a very broad range of species, and include bacteria, protozoa, algae and fungi. Most of these micro-organisms can multiply rapidly when the circumstances are right and they can have a major influence.

The microorganisms needed for plant growth
1. Bacteria.
2. Actinomycetes.
3. Fungi.
4. Algae.
5. Protozoa.
6. Composition regulation.
7. Soil microbiologists.
8. Earthworms and others

By adding above microorganisms we can make the grinded leaves into a best natural fertilizer for enhancing the growth of trees in a rapid manner [13]. The dried leaves of neem trees alone provide a best fertilizer for soil that may also be added along with the fertilizers.

Figure 2:The soil microorganism

V. HARDWARE RESULTS

PLC controller is the main heart of this project. Four number of inputs are given to the PLC controller they are main switch, proximity1, proximity2, level sensor. The outputs are the blower, cutting machine, dc motor at wheel forward and reverse, rack and pinion forward and reverse.

TABLE 2

INPUT	OUTPUT
X0 – main switch	Y0 – blower setup
X1–proximity 1	Y2–cutting machine
X2–proximity 2	Y3–motor forward Y4–motor reverse
X3–level sensor	Y5–rack and pinion open Y6 rack and pinion close

The PLC controller operates at 24V, hence every input given to it should be at 24 volts. The blower setup will operate in only 240V ac, so it is given through supply. Other components in the kit may work in dc supply.

In this kit the NPN type of proximity sensor is used, hence it gives negative 24v, so it should be converted into positive output by using relay in the connection. When the relay is connected with NPN type, it will give the positive output[5,3].The sink and source is the two types PLC controller. The sink type will operate with negative supply and source will operates with positive supply.

1. WORKING:

The supply is given to the kit and the main switch is switched ON, such that the blower starts running and it starts collecting the leaves from the ground and meanwhile the dc motors connected to wheel will rotate forward and reverse for collecting the leaves at different places[12,14]. When it senses the metal in the ground, the blower and the kit will stops such that the damages due to suction of metal pieces will get literally avoided. If metal pieces get in to the blower, it will cause damages to the blade.

The collected leaves will get partly grinded in the blower and spilled in the separate grinding part, where an extra grinding motor is located for fine grinding of leaves, along with it the fertilizers are added into the storage.

The float sensor is placed at the top of the storage such that if the storage yard gets filled, it will automatically stop the grinding motor and blower from collecting the leaves. The proximity sensor starts for detecting the metal attached at the trees for sensing the tree. After it senses the trees, the grinded fertilizers will automatically get deposited under the trees, After detecting that metal object, the PLC controller will send a signal to the H-bridge relay circuit, such that the opening provided at the bottom of the fertilizer storage will automatically get opened and deposit the fertilizer around the trees. Such that the trees get required nutrients. The H-bridge relay has forward and reverse signal for opening and closing of hole[12,1].

After some delay and deposition of fertilizers under trees, the opening will automatically close and goes to the next tree.

The low level sensor is placed for detecting the low amount of leaves in the storage; it will avoid unnecessary depositing process without leaves.

When the storage yard gets filled the float sensor sends the signal to the PLC Controller, such that the PLC Sends a signal to blower to stop functioning and it starts searching for metal in the trees. The low level sensor also sends the signs to the PLC Such that it starts for collecting leaves. The IR sensor is located at the front part of the kit

to detect an obstacle and it stops in their place. Such that the avoidance of damage of kit due to accident with an obstacle.
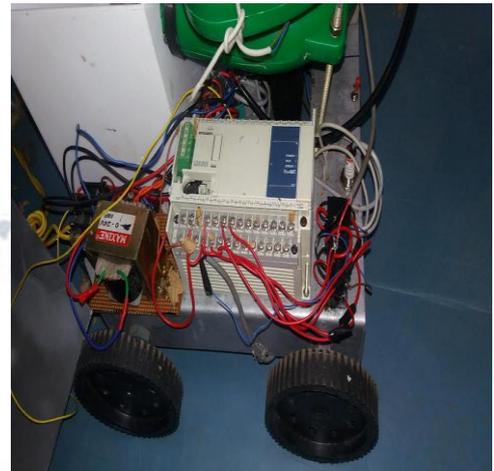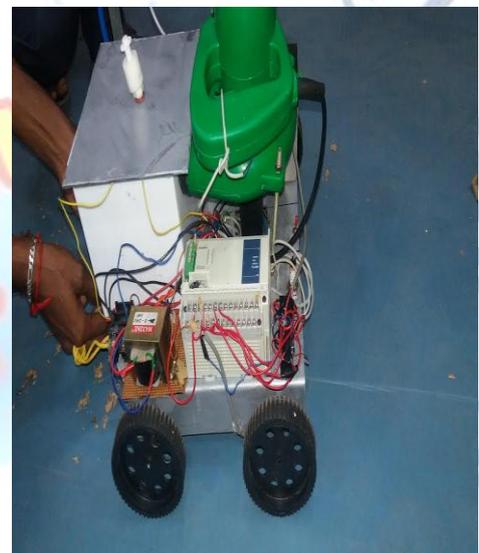

Figure 3: side view of hardware image (1)

Figure 4: side view of hardware image (2)

Figure 5: Top view of hardware image

VI. CONCLUSION

The problem of lack of nutrients to the plants will be overcome by this project and also if more fertilizers feeded under trees will retain the soil fertility and high amount of water under it will be maintained. By using this recycler and fertilizer deposition method, it will enhance the growth of plants in higher level and also give a perfect circumstances for survival of microorganisms, it will helps in plant growth faster.

FUTURE SCOPE:

1.The plastic papers and dried leaves can be separated and the plastic bags can be separately converted into bio fuels.

2. This ecofriendly machine can be developed further to operate with the solar energy.

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