AUTOMATED MULTIPURPOSE AGRIBOT

A PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DIPLOMA OF MECHANICAL ENGINEERING

Submitted by
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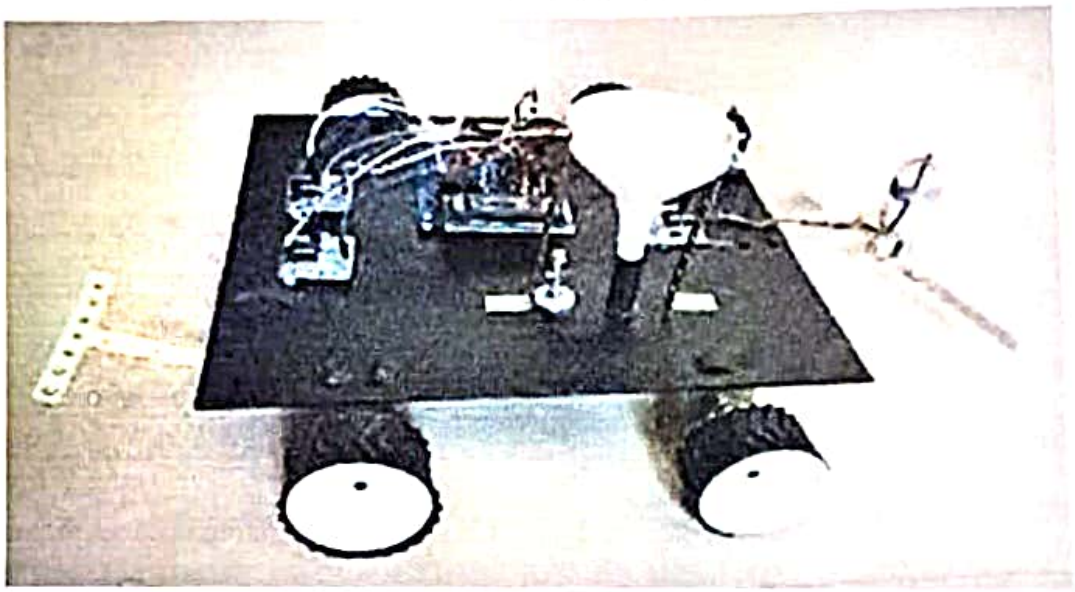

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CERTIFICATE

This is to certify that the project entitled "AUTOMATED MULTIPURPOSE AGRIBOT" submitted by Regd no. F20024004003 in partial fulfillment of the requirements for the award of diploma in Mechanical Engineering at the Balasore school of Engineering, Balasore (Under S.C.T.E&V.T.,Odisha) is an authentic work carried out by him under my supervision and guidance. To the best of my knowledge, the matter embodied in the project has not been submitted to any other institute for the award of any Diploma.

Date:

Principal
B.S.E., Balasore

PROJECT MENTOR

H.O.D.
Department,
Mechanical engg.

Abstract

The paper presents about the multiple agricultural tasks done by the single robot. To develop the efficiency of the agricultural tasks we have to find the new ways. This project deals with a novel approach for cultivating lands in very efficient way. The distinctiveness of this agriculture robot system is it is multitasking abilities which can drill, pick and place, seeding, pumping water & fertilizers, weather monitoring to work in both agriculture, afforestation and gardening platform. The project aim is design, development and the fabrication of the robot which can dig soil, put seeds, roller to close the mud and sprayer to spray water, this whole system of robot works with the help of battery and solar power. More than 40% of the population in the world chooses agriculture as the primary occupation, in recent years the development of the autonomous vehicles in the agriculture has experienced increased interest

Key word : *-ploughing, seeding, pick and place, Sprayer, Toggle switch, Battery, Solar panel.*

1.INTRODUCTION

Agriculture is the backbone of India. The history of Agriculture in India dates back to Indus Valley Civilization Era and even before that in some parts of Southern India. Today, India ranks second worldwide in farm output. The special vehicles play a major role in various fields such as industrial, medical, military applications etc., [1] The special vehicle field are gradually increasing its productivity in agriculture field. Some of the major problems in the Indian agricultural are rising of input costs, availability of skilled labors, lack of water resources and crop monitoring. To overcome these problems, the automation technologies were used in agriculture.

The agricultural census gives vital information on the distribution of land holdings in our country. According to the census majority of the farmers are having the land less than 1 hectare [2]. This is one of the major drawbacks for the mechanization in agricultural sector in India.

The vehicles are being developed for the processes for ploughing, seed sowing, leveling, water spraying. All of these functions have not yet performed using a single vehicle. In this the robots are developed to concentrate in an efficient manner and also it is expected to perform the operations autonomously. The proposed idea implements the vehicle to perform the functions such as ploughing, seed sowing, mud leveling, water spraying.[3] These functions can be integrated into a single vehicle and then performed.

Fig-1: Multipurpose agricultural robot

2. REASON FOR SELECTING THE PROBLEM

- This project objective is to fabricate a robot vehicle which can dig the soil, put the seeds, and close the mud and to spray water, these whole systems of the robot works with the battery and the solar power.
- To reduce human effort in the agricultural field with the use of small robot.
- To perform all 4 operations at single time, hence increases production and saves time.
- To complete large amount of work in less time.
- Farmer can operate this robot through remote by sitting at one side and he can operate easily.
- The usage of solar can be utilized for Battery charging. As the Robot works in the field, the rays of the sun can be used for solar power generation.
- To increase the efficiency, the solar power is used and the Power output can be increased.

3. LITERATURE SURVEY

In agriculture the use of robots enhances the productivity and reduces the human effort and cost. The automation of various agricultural activities by robots are envisioned. It has been described that the present robot can perform better and can automate more than one work simultaneously. This robot can be effectively used by the farmers. In future this robot can be enhanced with some more cognitive capabilities and also to take appropriate actions even in the absence of the farmers. It can be induced with human interaction and also learning from experience, given by Blackmore, S. (2007). "A systems view of agricultural robotics".[4]. Central to this idea was the proposal of the implementation of the PFDS and PADS, and their strong interaction. The PFDS is primarily used for relaying spatial accuracy information for machinery navigation, while the PADS are used to communicate the agronomy information about, and requirements of, the crop, given by R. Eaton, R. Eaton, J. Katupitiya, S D Pathirana (2008), "Autonomous farming: Modeling and control of agricultural machinery in a unified framework",[5].

4. PHYSICAL PARAMETERS

There are so many physical parameters considering while designing of multipurpose agricultural robot they are listed below.

4.1. FACTORS DETERMINING THE CHOICE OF MATERIALS.

The various factors which determine the choice of material are discussed below;

4.1.1. PROPERTIES

The material selected must contain the necessary properties for the proposed application. The following four types of principle properties of materials decisively affect their selection;

- Physical
- Mechanical
- From manufacturing point of view
- Chemical

The various physical properties concerned are melting point, Thermal Conductivity, Specific heat, coefficient of thermal expansion, specific gravity, electrical Conductivity, Magnetic purposes etc. The various Mechanical parameters considered are strength in tensile, compressive shear, bending, torsional and buckling load, fatigue resistance, impact resistance, elastic limit, endurance limit, and modulus of elasticity, hardness, wear resistance and sliding properties. The various properties concerned from the manufacturing point of view are,

- Cast ability
- weld ability
- Brazability
- Forgability
- merchantability
- surface properties
- shrinkage

4.1.2. MANUFACTURING COST:

Sometimes the demand for lowest possible manufacturing cost or surface qualities obtainable by the application of suitable coating substances may demand the use of special materials.

4.1.3. QUALITY REQUIRED:

This generally affects the manufacturing process and ultimately the material. For example, it would never be desirable to go for casting of a less number of components which can be fabricated much more economically by welding or hand forging the steel.

4.1.4. AVAILABILITY OF MATERIAL:

Some materials may be scarce or in short supply. It then becomes obligatory for the designer to use some other material which though may not be a perfect substitute for the material designed. The delivery of materials and the delivery date of product should also be kept in mind.

4.1.5. SPACE CONSIDERATION:

Sometimes high strength materials have to be selected because the forces involved are high and the space limitations are there. There are also some restrictions to what we can utilize in the mechanism.

4.1.6. COST:

As in any other problem, in selection of material the cost of material plays an important part and should not be ignored. Sometimes factors like scrap utilization, appearance, and non-maintenance of the designed part are

involved in the selection of proper materials.

5. DESIGN OF BODY

- Base Frame: 18 X 20"
- Solar Panel: 5W (power), 15 X 7" (dimension)
- Ground Clearance: 6"
- PVC Wheel: 6"
- Lead screw: 2mm pitch, 18mm diameter (For ploughing)
- M.S square pipe for base: 1", 18 gauge
- M.S flat plate: 1", 3mm thickness
- Seeder funnel: 2
- Ploughing tooth: 2

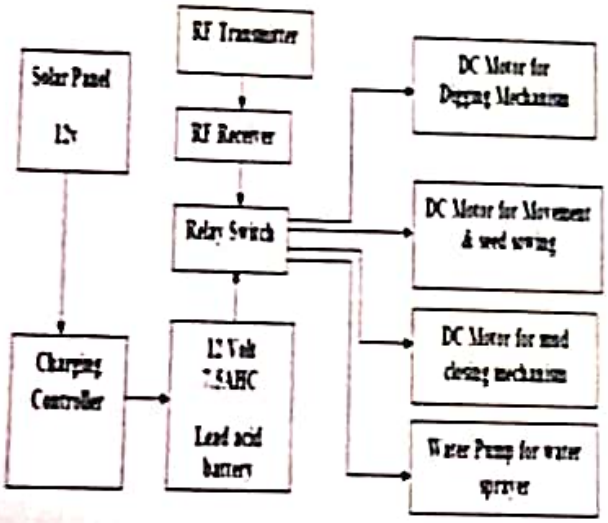

Fig. 2: Block diagram of Multipurpose Agricultural Robot

6. OPERATIONS

Our robot can perform the various operation like, Steering operation, ploughing operation, cultivating operation, spraying operation.

6.1. STEERING OPERATION

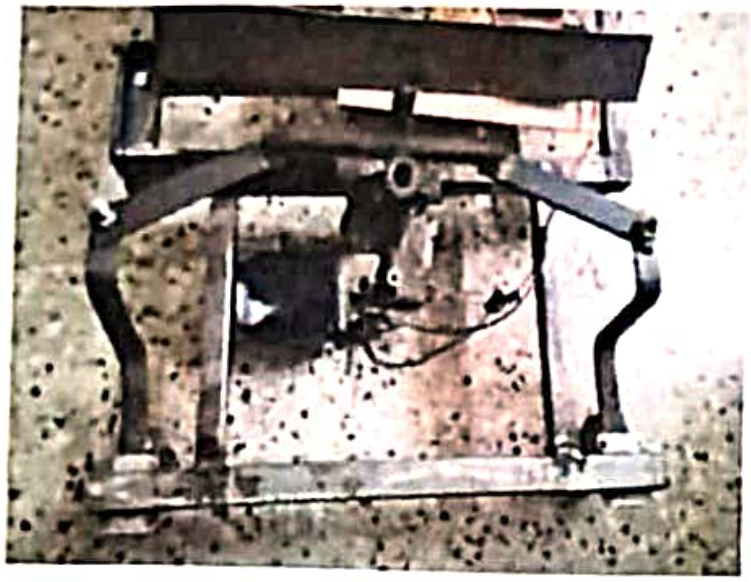

fig-3: Steering Operation

- Rack and pinion Mechanism for steering operation.
- The pinion is coupled with the DC Motor.
- The power for motor is regulated by Relay switch.

6.2. **The direction of motor rotation can be controlled by remote controller for steering the vehicle to either left or right side direction. CULTIVATING OPERATION**

Fig-4: Cultivating opertion

- A DC Motor coupled with the screw rod is used.
- The power for motor is regulated by relay switch.
- The screw rod rotates and the nut welded to the cultivator slides between the screws of the screw rod.
- As the cultivator is lowered down, soil is digged up to 1.5 inches.
- The direction of motor rotation can be controlled by remote controller for up and down movement of the cultivator

6.3. SEED SOWING OPERATION

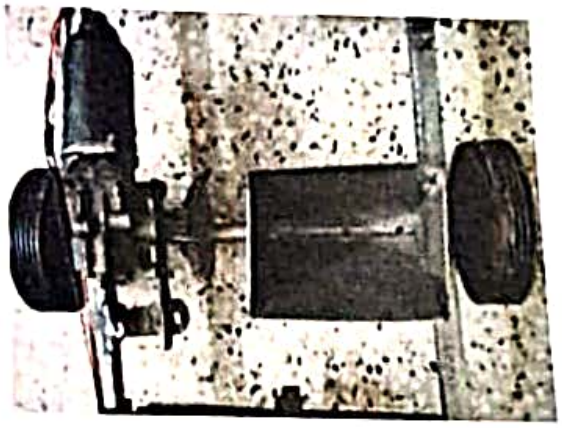

Fig-5: Seed sowing operation

- A sheet metal hopper box is used for Seed storage.
- We have provided 3 holes to the main wheel shaft, where the Storage box is placed above it.
- The main wheels are powered by DC motor which is regulated by a Relay switch and is controlled by a remote controller.
- As the motor is switched on, the wheels tend to rotate and rotation of shaft makes the seeds fall on the cultivated filed. There is time gap where seeds is alternately fed to the ploughed field

6.4. MUD CLOSING AND LEVELING OPERATION

Fig-6: Mud Closing and Leveling Operation

- A Sheet metal Plate is used as mud closer and leveler.
- The sliding mechanism is used for leveler up & down movement.
- The Leveler is powered by a DC motor which is regulated by Relay switch and controlled by a remote controller.
- As the leveling plate moves downward to the ground level, the mud is closed in the sowed soil

6.5. WATER SPRAYING OPERATION

Fig-7: Water spraying Opertion

- A water container is used for water storage.
- A water pump is used for pumping water to the water sprayer.
- The water flows to the sprayer through pipe.
- The power for pump is regulated by a toggle switch

I. METHODOLOGY

The basic aim of this paper is to develop a multipurpose machine, which is used for digging the soil, seed sowing, and leveler to close the mud and water sprayer to spray water with least changes in accessories with minimum cost. This whole system of the robot works with the battery and the solar power. Micros, Spectrum ZX and Commodore 64 machines that people of an earlier generation learned to program on.

- The base frame is made for the robot with 4 wheels connected

- IR Sensor
- Soil Moisture Sensor
- Bluetooth
- Robot
- Motor Driver
- Pumping Motor

II PIC 16F877A Microcontroller is used in this agribot.IR sensor is used to detect the obstacles. Soil moisture sensor is used to detect the moisture content in the soil. Through Bluetooth we can able to get the information about the working of agribot. Motor driver is used to make the robot move on the ground. Pumping motor work is to pump the water to the agricultural field

III. WORKING PRINCIPLE

The project aims on the design, development and the fabrication of the robot which can dig the soil, leveler to close the mud and turn on and turn off the motor depending on water level in the ground and this whole system of the robot works with the battery and the solar power. The language input allows a user to interact with the robot which is familiar to most of the people. The advantages of these robots are hands-free and fast data input operations. In the field of agricultural autonomous vehicle, a concept is been developed to investigate if multiple small autonomous machine could be more efficient than traditional large tractors and human forces. Keeping the above ideology in mind, a unit with the following feature is designed:

- Robot has rotor which will destroy the unwanted grasses while

moving and also level the ground.

- All the operations are performed with the help of PIC microcontroller.

Humidity sensor is used to sense the moisture content in the environment.

- Moisture sensor is used to sense the water level in the ground and turn on and turn off the pumping motor depending on water level.
- The robot also has a digger to dig the vegetables from the ground.
- Bluetooth is used to send the message to the farmer about the operation performed by robot.

IV

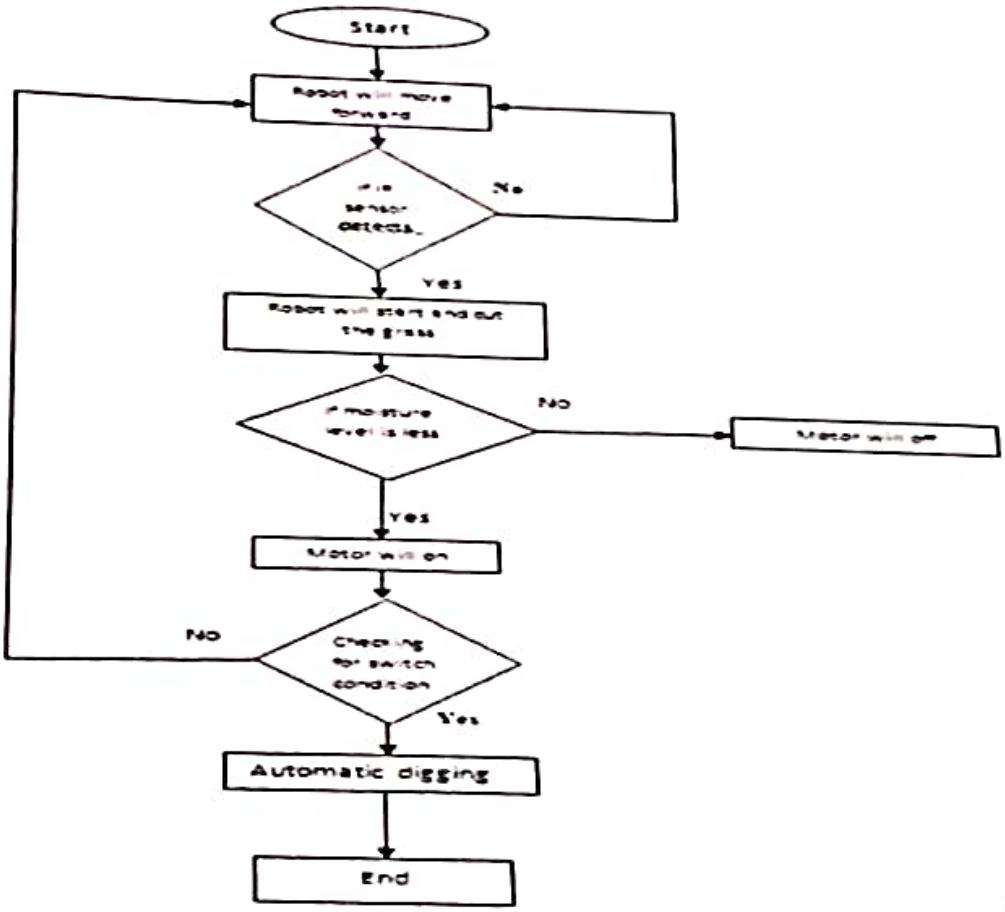

Fig: Flow chart of smart phone operated multipurpose agricultural robot

Step 1 - Power on the robot.

Step 2- Robot starts moving forward and all sensors powered on. Step 3 - IR sensors senses for unwanted grass (or) weeds.

Step 4 - If IR sensor sense the presence of weeds (or) grasses then rotor starts rotating to cut grass (or) weed plants.

Step 5 - Moisture sensor is used to check moistness in the soil to water the plants.

Step 6 - If moisture sensor is low, sensor turns on the water pump (or) if moisture is high, sensor turns off the water pump. Step 7 - Repeat Step 3 to Step 6 periodically.

Step 8 - Switch is used to turn on ploughshare for digging the field (or) farm.

Step 9 - Smart phone is connected to robot through Bluetooth interface app.

V. EXPERIMENTAL RESULTS

i Introduction

Project is constructed as agribot (4 – wheeled robot) using PIC microcontroller 16F877A, IR sensors, Moisture sensors, Water pump motor, Motor driver, DC motor, Robotic arm, Switch, Rotor, Solar panel.

ii Working

Agribot (4 – wheeled robot) is initiated with the power "ON". The agribot starts moving in forward direction along with the two sensors – IR sensor and Moisture sensors are also turned "ON". These are used to monitor the environment in real time. IR sensors are used to turn on rotor in order to cut the unwanted weeds (or) grasses. Likewise, moisture sensors are used to sense moistness in the soil and turn ON or OFF the water pump for watering the plants. Robotic arm is constructed by switch for ploughing the land.

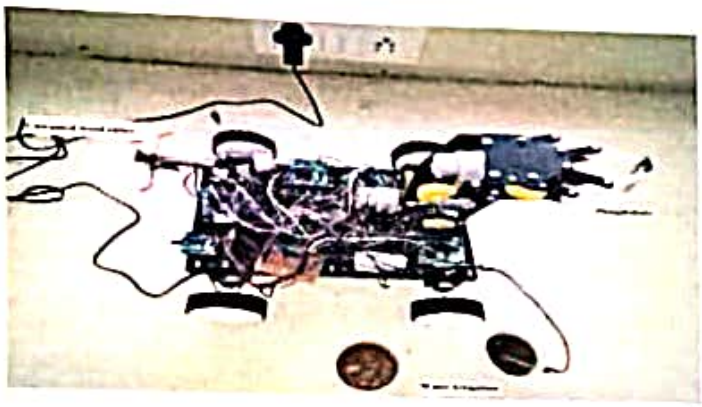

Fig 5.2: Working of the Agricultural robot

iii. Manual mode

Robot is operated in manual mode only for control purpose. It is used to start the Robot and make it move in forward direction. The three important

mechanisms are – (i) Rotor is turned ON/OFF through IR sensors detecting unwanted grasses. (ii) Water pump is turned ON/OFF using moisture sensor based on detecting the moistness in soil. (iii) Robotic is turned ON/OFF through a switch for ploughing the land.

iv. Auto mode

Bluetooth interfaced android app is used to monitor the operation status of Robot. Steps involved in monitoring of Robot –

(1) Application scans for the Bluetooth interface (HC-05) Robot.

(2) (2) once, the robot connected to the phone successfully.

(3) (3) There are three 3 communication mode –
Byte stream mode, (ii) Keyboard mode, (iii) Command line mode.
(4) Select Byte stream mode – Successfully connected.
(5) In Byte stream mode, operational status of agribot – (i) Pumping motor ON (or) (ii) Rotor is on for leveling or removing grass. (iii) Robot is going to digging

APPLICATIONS

- Robot has rotor which will destroy the unwanted grasses while moving and also level the ground.
- The robot also has a digger to dig the vegetables from the ground.
- In Automatic turn on and turn off of water pumping motor.

VI. FUTURE WORK

Robotics is playing a significant role in agricultural production and management. There is a need for autonomous and time saving technology in agriculture to have efficient farm management. The researchers are now focusing towards different farming operational

parameters to design autonomous agricultural vehicles as the conventional farm machineries are crop and topological dependent. Till date the agricultural robots have been researched and developed principally for harvesting, chemical spraying, picking fruits and monitoring of crops. Robots like these are perfect substitute for manpower to a great extent as they deploy unmanned sensing and machinery systems. The prime benefits of development of autonomous and intelligent agricultural robots are to improve repeatable precision, efficacy, reliability and minimization of soil compaction and drudgery. The robots have potential for multitasking, sensory acuity, operational consistency as well assuitability to odd operating conditions. The study on agricultural robotic system had been done using model structure design mingled with different precision farming machineries. Few prototypes were designed by European Union named CROPS, USA-ISAAC2 & Michigan- Hortibot, Australia-AgBot, Finland-Demeter, India-Agribot and many other countries. The agricultural robots are designed using different localization techniques which are vision, GPS, laser and sensor based navigation control system. In this paper, comparative study including an overview of Robotics approach for precision Agriculture in India and worldwide development is explored.

7. CONCLUSIONS

The multipurpose agricultural robot gives an advance method to sow, plow and cut the crops with minimum man power and labor making it an efficient vehicle. The machine will cultivate the farm by considering particular rows and specific column at fixed distance depending on crop. Robots can improve the quality of our lives and enhance opportunities for future mankind to create an upgraded model for the betterment of farmers. In agriculture, the opportunities for robot-enhanced productivity are immense and the robots are appearing on farms in various guises and in increasing numbers. The other problems associated with autonomous farm equipment can probably be overcome with technology.This equipment may be in our future, but there are important reasons for thinking that it may not be just replacing the human driver with a computer. It may mean a rethinking of how crop production is done. Crop production may be done better and cheaper with a swarm of small machines than with a few large ones. One of the advantages of the smaller machines is that they may be more acceptable to the non-farm community. The jobs in agriculture are a drag, dangerous, require intelligence and quick, though highly repetitive decisions hence robots can be rightly substituted with human operator. The machine requires less man power and less time compared to traditional methods, so if we manufacture it on a large scale its cost gets significantly reduce and we hope this will satisfy the partial thrust of Indian agriculture. So in this way we can overcome the labor problem that is the need of today's farming in India.

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