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Weed destruction rover for coconut groves

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***Abstract*— In this paper, we present to you an autonomous rover for agriculture. This rover will be able to traverse a specified area, detect and destroy unwanted plant (weeds) in it. This rover is very useful as it is an alternate for direct human interface with the agricultural process. The rover is controlled by an ATMEGA 32 microcontroller and powered by a rechargeable battery which reduces its maintenance.**

***Index Terms*— Agriculture, Weed, Rover, Microcontroller.**

I. INTRODUCTION

India is basically an agricultural nation. The technological advancements in agriculture mainly concentrate on the yield enhancement and reduction of crop mortality. Weed is a major threat to crops as it absorbs vitals and curb the crop of its nutrients. Although weed reduction has seen a growth in terms of eradicating them manually by farm labours in an action of spraying weedicide or physically removing them. The lack of farm labour has caused a serious threat in control of weed. An autonomous rover which will be able to detect and destroy weeds in an agricultural field will be a solution to this problem.

II. PROBLEM IDENTIFICATION

In agriculture weed management is a tedious process. It involves a requirement for large man power and in some time machine power also. Some of the problems faced in the existing methods are

- *Administering herbicides* –chemicals like glycel are poisonous they pollute the land degrading the soil quality.
- *Hand cutting* – human labour is scarce and has become a costly investment. More over labours working in fields face threats from poisonous insects and reptiles.
- *Mechanised cutting* – Power tools are powered by petroleum fuels or by battery. Petroleum fuels has its own disadvantage of cost. Manual labour is used for operating these machines, the cost of labour for operating these machines is also comparatively high.

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III. PROPOSED METHOD

To overcome the problems faced by the existing methods, a rover will be an affordable solution for the control of weeds.

- A rover controlled by a microprocessor will navigate the field.
- It will travers a path that will cover the entire field .
- If it detects a weed in its path it will stop and activate its cutters to cut the weed.
- If the rover detects a tree it will traverse a path around it.

IV. BLOCK DIAGRAM

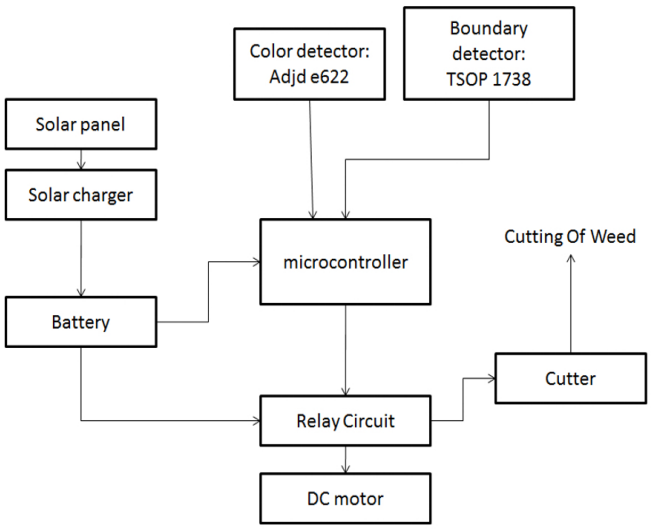

Fig.1.Block Diagram

V. HARDWARE USED

- **Microcontroller ATMEGA 32**

Operating voltage :2.7 - 5.5V V
Pins : 40, Memory 32Kb

- **RGB Color sensor**

Operating voltage : 5 V
range : 1-5 cm

- **IR proximity sensor** TSOP 1738

operating voltage : 5 V
range : 1-5 cm

- **Motor**

speed : 60 rpm
operating voltage : 12 V

- **Solar panel**

Power : 5W
Size: 12”X12”

- **Relays**

Operating voltage: 5V

Current: 5A
Switching voltage: 12V

- **Servo motor**
  3.0kg.cmat 4.8v or 3.5kg.cm at 6.0v

VI. SOFTWARE USED

Embedded C is the language used to write the codes for the rover and it was tested and uploaded onto the microprocessor using WINAVR

VII. CONTROL METHOD

In this project a rover for detection and destruction of weeds is designed. The rover has a metal chassis. Two 60 rpm geared motor are used to drive the rover. The motors drive a track belt which is capable of traversing in any terrain.
The rover is controlled by a microcontroller which serves as a brain for the rover. A colour sensor or detector is used to detect weed in the field. A proximity sensor is used to detect any obstacles in the path.
A servo motor is used to control an arm on which a cutter is mounted. When a weed is detected the rover stops and the servo swings the arm which cuts the weed.

VIII. WORKING PROCESS

This working process describes the various process involved in the operation of the rover.

IX. ROVER NAVIGATION

The rover is programmed to roam around in a specified area of a field. The proximity sensors help in navigation around the specified area. The chassis of the rover is fitted with track belts with which the rover moves around the field. When ever the color detector detects a weed the rover stops and weed cutting process takes over.

Fig.2.Rover Side View

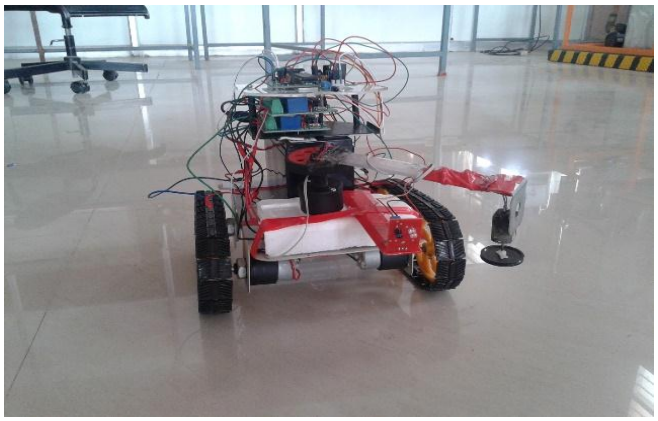

Fig.3.Rover Front View

X. WEED DESTRUCTION PROCESS

When the color detects the weed it interrupts the navigation process and a servo motor controlling an arm swings forward and a cutter at the end cuts the weed

Fig.4.Rover Cutting Weeds

XI. PROGRAM

```
#include <avr/io.h>
#include <util/delay.h>
#define THRES 500
// initialize adc
voidadc_init(void)
{
   // AREF = AVcc
  ADMUX = (1<<REFS0);
   // ADC Enable and prescaler of 128
   // 16000000/128 = 125000
   ADCSRA
(1<<ADEN)|(1<<ADPS2)|(1<<ADPS1)|(1<<ADPS0);
}
// read adc value
uint16_t adc_read(uint8_t ch)
{
   // select the corresponding channel 0~7
   // ANDing with '7' will always keep the value
// of 'ch' between 0 and 7
ch&= 0b00000111;  // AND operation with 7
   ADMUX = (ADMUX & 0xF8)|ch;    // clears the bottom 3
bits before OR ing
```

```
   // start single conversion
   // write '1' to ADSC
   ADCSRA |= (1<<ADSC);
   // wait for conversion to complete
   // ADSC becomes '0' again
   // till then, run loop continuously
while(ADCSRA & (1<<ADSC));
return (ADC);
}
int main(void)
{
   uint16_t adc_result0 , adc_result1;
   DDRC = 0x01;          // to connect led to PC0
    // initialize adc and lcd
adc_init();
while(1)
   {
      adc_result0 = adc_read(0);
      adc_result1 = adc_read(1);      // read adc value at PA0
      // condition for led to glow
if (adc_result0 < THRES || adc_result1 < THRES)
      {
         PORTC = 0x06;
         _delay_ms(4000);
}
else if (adc_result0 < THRES || adc_result1 > THRES){
         PORTC = 0x02;
         _delay_ms(4000);
         }
         else if (adc_result0 > THRES || adc_result1 <
THRES){
         PORTC = 0x01;
         _delay_ms(4000);}

         else if (adc_result0 > THRES || adc_result1 >
THRES)
         {
         PORTC = 0x04;
         _delay_ms(4000);
   }
}}
```

XII. Conclusion

The design is a success and is in working condition satisfying the requirements provided. The rover can be used for various other agricultural activites satisfactory compared to the conventional system for a dedicated applications.

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