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Design and Development of Colour decoding Agri-robot.

P.P Kharche[1] , Mayuresh Bankar[2], Omkar Jadhav[3], Shubham Jagadale[4], Shubham Shelar[5].

Prof [B.E], Dept. of Mech., Smt. Kashibai Navle College of Engineering, Vadgaon, Pune, India[1]

UG Student [B.E], Dept. of Mech., Smt. Kashibai Navle College of Engineering, Vadgaon, Pune, India[2]

UG Student [B.E], Dept. of Mech., Smt. Kashibai Navle College of Engineering, Vadgaon, Pune, India[3]

UG Student [B.E], Dept. of Mech., Smt. Kashibai Navle College of Engineering, Vadgaon, Pune, India[4]

UG Student [B.E], Dept. of Mech., Smt. Kashibai Navle College of Engineering, Vadgaon, Pune, India[5]

***Abstract* – The main aim of the work is to design and develop pesticide spray with varying time & color of the leaf. The 3 D model is created. All the parts are manufactured and then assembled together and then the testing of model is carried out. To check whether the proposed system works as per the requirement or not.**

To develop the semi-automated spraying equipment, one must go through the embedded system to integrate the program. This system is based on the mechatronics system, it has spraying arrangement, embedded color sensing capability & dynamic motion on the ground level.

Key Words* : *Pesticide spray, time, color, Embedded & sensing color.

I. INTRODUCTION

There are many types of pesticides sprayer are available in India. But mostly used sprayer is backpack type sprayer which is used by farmers because it is cheaper, easy to use but it requires lot of time. Also, the farmer which is spraying pesticides is affected by it as it is harmful to human health and human also affect by the lumbar pain due to weight of equipment. Thus, this work vigorously describes the design and construction of a robot featuring plant spraying mechanism for pesticide with varying spray. To realize this work, we provide a compact, portable and a well-founded platform that can survey the farmland automatically. This approach will help farmers using fundamental principles of Sensor's technology.The main aim of our work is to design and develop pesticide spray with varying the timing machine. The 3 D model is drawn. All the parts are purchased and then assembled together and then the testing of model will be carried out carried out.This robot can spray the pesticides depending upon the colour of plantation.

The main business of Indian people is agriculture and the economy of the nation is decided by agriculture. The essential nutrients for plant growth are commonly generates in its surroundings. The plant development process depends on the conditions of the environment, where plant grows. The plant development process depends on the conditions of the environment, where plant grows. The necessary parameters like, humidity, light, moisture, ambient temperature and CO2 etc. are consists in the environment. Deep understanding of all these factors and their relationships can help the farmer to get much familiar with any of the potential problems that will affect the health of the plants and thereby more appropriate and accurate measures can be taken to get rid of these problems.

II. LITERATURE REVIEW

A. "Agricultural robots for field operation: Concepts and Components," : Revieved by Avital Bechar, Clement Vigneault.

This journal represents the, developments and innovation in agricultural robots for field operations, and the associated concepts, principles, limitations and gaps. Robots are highly complex, consisting of different sub-systems that need to be integrated and correctly synchronised to perform tasks perfectly as a whole and successfully transfer the required information. Extensive research has been conducted on the application of robots and automation to a variety of field operations, and technical feasibility has been widely demonstrated. Agricultural robots for field operations must be able to operate in unstructured agricultural environments with the same quality of work achieved by current methods and means. To assimilate robotic systems, technologies must be developed to overcome continuously changing conditions and variability in produce and environments. Intelligent systems are needed for successful task performance in such environments.

B. "Design and fabrication of a solar powered autonomous agricultural robot,": Reviewed by Kavita Zole, Sanghasevak Gedam, Aditya Dawale, Kiran Nikose, Jayant Hande.

In this article present design agricultural robot which is based on electronic and mechanical (Mechatronics) platform that perform advance agriculture process. This paper strives to develop a robot capable of performing operation like automatic ploughing and seed dispensing. We have developed an electromechanical vehicle which is steered by DC motor to drive wheels.

The farm is cultivated by the automated system, depending on the crop considering particular row and specific columns. This work controlled by remotely and solar panel is used to charge DC battery. In this journal author tried to present related work of agricultural robot as labour problem can be reduced as compared to the manual and tractor based sowing time, energy required for this robot machine is less. At the same time by using solar energy environment pollution can also be reduced. Development and Automation of Robot with Spraying Mechanism for Agricultural Applications. This is achieved by the design and construction of an autonomous mobile robot for use in pest control and disease prevention applications in commercial Farm.

C. "HRI usability evaluation of interaction modes for a teleoperated agricultural robotic sprayer," : Reviewed by George Adamides, Christos Katsanos, Yisrael Parmet, Georgios Christou, Michalis Xenos , Thanasis Hadzilacos, Yael Edan.

This literature shows teleoperation of an agricultural robotic system requires effective and efficient human-robot interaction. This paper investigates the usability of different interaction modes for agricultural robot teleoperation. Specifically, we examined the overall influence of two types of output devices (PC screen, head mounted display), two types of peripheral vision support mechanisms (single view, multiple views), and two types of control input devices (PC keyboard, PS3 gamepad) on observed and perceived usability of a teleoperated agricultural sprayer. A modular user interface for teleoperating an agricultural robot sprayer was constructed and field-tested. Evaluation included eight interaction modes: the different combinations of the 3 factors. Thirty representative participants used each interaction mode to navigate the robot along a vineyard and spray grape clusters based on a 2 2 2 repeated measures experimental design.

D. "Development of Smart Pesticide Spraying Robot," : Reviewed by Pvr Chaitanya, Dileep Kotte, A. Srinath, K. B. Kalyan.

This article presents the management of food crops includes very close surveillance, particularly with regard to the treatment of Illnesses, which will cause severe effects after harvest. Disease is recognized in crops as the shift or deficiency of the plants ordinary functions that will generate certain symptoms. The disease that causes agents in plants is mainly defined as any agent's pathogens Most of these pathogenic agents signs are seen in the leaves, stems and branches of the crops. Consequently, the diagnosis of disease and the proportion of disease produced in crops is compulsory for effective and successful plant cultivation. This can be done through taking input images using camera, analysing them using machine learning process. This displays the disease presented on the leaf, stem or plant. This also displays the exposed area to disease and also predicts the remedies, turn on the pesticide sprayer which sprays the respective pesticide on the exposed area to disease. This is very necessary for effective spraying of the pesticide.

E. "Application of systematic methods in the electromechanical design of an agricultural mobile robot," Reviewed by Rubens Andre Tabile, Eduardo Paciencia Godoy, Giovana Tripoloni Tangerino, Arthur José Vieira Porto, Ricardo Yassushi. Inamasu, Rafael Vieira de Sousa.

This journal shows a current trend in the agricultural area is the development of mobile robots and autonomous vehicles for precision agriculture. One of the major challenges in the design of these robots is the development of the electromechanical components. This platform has as main characteristics four-wheel propulsion and independent steering, adjustable gauge, ground clearance of 1.80 m, diesel engine, hydraulic system, and a CAN-based networked control system. The aim of this work is to describe the work of an experimental platform for data acquisition in field for the study of the spatial variability and development of agricultural robotics technologies to operate in agricultural environments.

F. "Autonomous Pesticide Spraying Robot for use in a Greenhouse," Reviewed by Philip J. Sammons, Tomonari Furukawa and Andrew Bulgin.

This paper presents an engineering solution to the current human health hazards involved in spraying potentially toxic chemicals in the confined space of a hot and steamy glasshouse. This is achieved by the design and construction of an autonomous mobile robot for use in pest control and disease prevention applications in commercial greenhouses. The effectiveness of this platform is shown by the platforms ability to successfully navigate itself down rows of a greenhouse, while the pesticide spraying system efficiently covers the plants evenly with spray in the set dosages. At the far end of the greenhouse the induction sensors successfully detected the end of the rail, enabling the platform to change direction, moving back along the rails and returning to the start. The wheel assembly was successful in delivering a smooth transition from the rails to the concrete slab where the induction sensors identified the start of the rail and brought the platform to a stop.

III. CONSTRUCTION AND WORKING

This work is a combination of Electronics & Mechanical called Mechatronics. It has a Arduino controller which works as a brain to this work.Colour sensor is used to identify the colour of a leaf predicting up on its colours like green, yellow & brown.A storage containing pesticide fluid with water motors and supplies like pipe and nozzle.Battery for power supply.Dc motors and drivers for the motion of the Agri-Bot, can be controlled with Arduino programing. Fertilizer Agri-Robot consist of color sensor & ARDUINO MEGA as main controller,.Color sensor recognizes the color of a sapling and sends the signal to the Arduino mega (which acts as a main controller) through relay. As the Arduino mega receives the signal, it drives the water motor in the tank & pumps water through the pipe from which the fluid is sprayed to the sapling with the help of nozzle. Here, time taken for water fertilization is controlled depending upon the color of a sapling. An the delay is given in the water motor upon sensing particular colour of plant as mentioned below.

For an example

A. Green color = Less water = 5 sec

B. Yellow color = Medium water = 10sec

C. Brown color = More water =15 sec

A. Arduino Mega :-

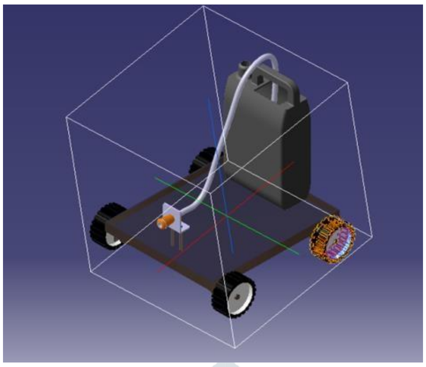


Fig. 1 Iso View of Full Work

III. COMPONENTS

The Arduino Mega 2560 is a microcontroller board based on the ATmega2560 (datasheet). It has 54 digital input/output pins (of which 14 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

Fig. 2 Arduino Mega

B. Colour Sensor :-

Color Sensor, based on TCS3200, is a complete color detector capable of detecting static color.
The output of the sensor is a square wave with frequency directly proportional to incident light intensity. It also supports fill light by on board LEDs. It includes a TAOS TCS3200 RGB sensor chip and 4 white LEDs. The TCS3200 can detect and measure nearly limitless range of visible colors. Applications include test strip reading, sorting by color, ambient light sensing and calibration, and color matching, to name just a few.

Fig. 3 Colour Sensor

C. DC Motor :-

DC Motor is used to rotate the wheel which is used to move the machine from one place to another.An electric motor is an electrical machine that converts electric energy into mechanical energy. Most electric motors operate through the interaction between the motor's magnetic field and winding currents to generate force in the form of rotation. Electric motors can be powered by direct current (DC) sources, such as from batteries, motor vehicles or rectifiers, or by alternating current (AC) sources, such as a power grid, inverters or electrical generators.

Fig. 4 DC Motor [2]

IV. CALCULATIONS

A. FRAME:-

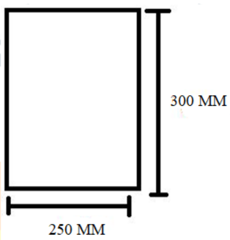


Figure 3.2.1 frame dimension for stress calculation

$$\boldsymbol{M}/\boldsymbol{I} = \sigma \mathbf{b}/\boldsymbol{Y} \quad \text{......s. (1)}$$

Area of rectangular

Thickness = 4 MM

W = 300 MM

L = 250 MM

The total surface area of the rectangular prism is given by:

A = 2(lb + bh + lh)

= 2((300 * 200) + (250 * 4) + (300 * 4))

= 154400 mm^2

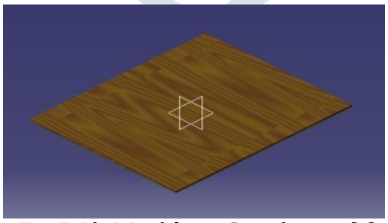


Fig. 5 Ply Wood frame Catia drawing [1]

Mass = 0.192 Kg

= 0.192 * 9.81

= 1.88352 N

From CATIA v5 software @ Area = 154400 mm2

= 0.154 m2

Moment of Inertia ICM = 1/12 * M (w2 + l2)

= 1/12 * 1.88352 (300^2 + 250^2)

= 23936.4 Nmm2

(Formulas are taken from khurmi gupta-reference book.)
M/I = σb/y…………………………………………………………….(1)
Bending moment (M) = force *perpendicular distance

- Force = total load from CATIA = 3.363 * 9.81 = 32.99103 N
- FOS = 1.5 = 32.99103 * 1.5 = 49.48 N = 50 N
- Perpendicular distance = 300/ 2 = 150 mm
- M = 50 * 150 = 7500 Nmm^2
- I = 23936.4 mm2
- Y= Distance of the layer at which the bending stress is consider = 4
- 4/2 = 2 mm
- Sigma b = M * Y / (I)
  = 7500 * 2 / (23936.4)
  = 0.626N/mm^2
- Wood Plywood13.8 Ultimate Yield strength
  0.626N/mm2< 13.8 N/mm2
- **Hence Design is safe.**

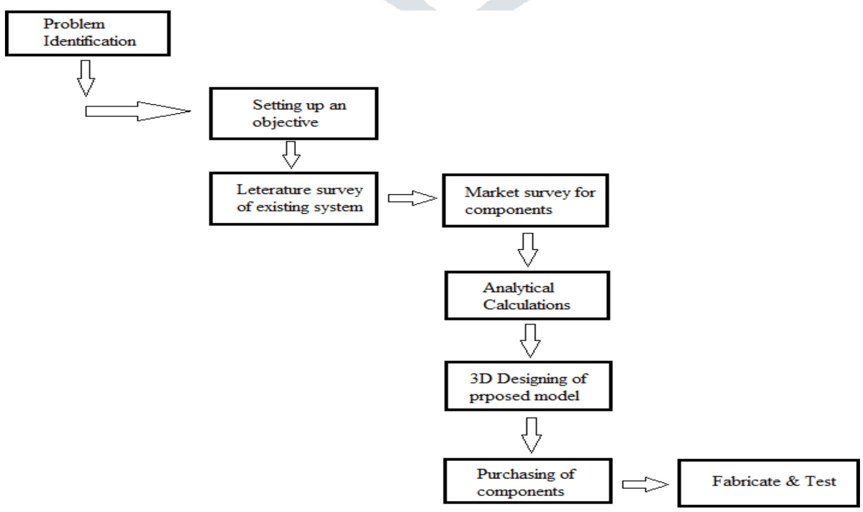
B. SELECTION MOTOR:-

- 50 N Total Load But Load Is Divided Into 4 Wheels Which Is + 2.5 lter waters =2.5kg=2.5 * 9.81 = 28.449 = 30N
  = 50 + 30/4 = 20 N
- Torque = ½ Force * Diameter
  = ½ *20 * 70 mm =700 Nmm^2
  = 7.13 Kg/Cm^2
- Diameter = diameter of wheel (d= 70 mm) standard available in market.
- Force = total force including all components (45 N)

C. HYDRAULIC PUMP OR MOTOR:-

- Assumption
- W = 2Kg = of water to be transferred from reservoir to the panel. = 2000grm
- T=Foratimeof1min=60Sec
  Delta (h) = 1m
- $P = \frac{W}{T}$
- W = Fd
  W = mg*Delta (h)
- $P = \frac{m}{T}$ * g * Delta (h)
- $\frac{2Kg}{min}$ * $\frac{1min}{60sec}$
  = 0.0334 Kg/sec
  P = 0.0334 * 9.81 * 1
- = 0.327 Kw required
- Power of water pump
- According to this we will select water motor required as per the availability in Market

V. METHODOLOGY



VI. BILL OF MATERIAL

Sl No	Part	Specs	Cost
1.	Frame	Plywood 1x 300*200*4 mm	275/-
2.	L-Clamp	40*40*3mm 4x	245/-
3.	Wheel	DIY 4x 70 mm dia	365/-
4.	DC motor	30Rpm 2x 5KGf.cm	785/-
5.	Dummy wheel	2x	75-
6.	Bluetooth	HC-05 Module 1x	452/-
7.	Arduino Uno	1x	945/-
8.	Battery	1x 12v 5.2amph	1240/-
9.	Relay	1x 5VDc	75/-
10	Color Sensor	Tcs 2500	675/-
11.	Nozzle, Mini water motor, HDPE Storage tank & pipe	1X	850/-
	Total		**5982/-**

TABLE I

VII. CONCLUSION

This type of system is very helpful for agriculture purpose to spray the pesticide to different crops. Currently we use a system that increase the human effort and it also not comfortable. This pesticide sprayer robot move in fields and robot has sensors to detect the plants on both sides. In this system we use small tank for pesticides and motor. If it detects plant then automatically it will start to spray. This system also has a wireless camera which can capture the image and display it on the display. By making some modification we can use this system for other type of application.

VIII. FUTURE SCOPE

1] As this is prototype when we go for large scale production it will increase atomization of agriculture.
2] Solar panel we can add to charge the battery
3] System can fully automated if we use camera with raspberry pie module for auto detection & movment.

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