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Development of Agricultural Rover for Monitoring and Sprinkling of Pesticides on Field Crops

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Abstract - The backbone of the Indian economy is agriculture, and a sizable portion of the population depends on it for a living. The 'Agricultural Rover' is designed to give farmers a complete tractor replacement and support different farming practises. India's traditional agricultural practises relied on draught animals. Bulls and bullocks are used by the majority of small-scale farmers to pull the plough and other similar implements. This rover is intended to take the place of the traditional and well-established farm equipment. An appropriate battery pack powers the electric motor that propels this agricultural rover. It is able to carry out almost all of the main agricultural tasks including ,monitoring , spraying fertiliser, watering, etc. An electromechanical vehicle called a rover was created to provide farmers with intelligent equipment and environmentally friendly farms for increased production. By using this rover, farmers will be more productive and their crops will yield more, all while using less physical labour. By using this rover, the issue of uniformly spraying,monitoring by camera is possible. This project presents the design and construction of an autonomous robot that seeks to address.some of the human health concerns associated with farms. This robot is designed as abase for developing systems to enable the automation of farming processes such as the spraying of pesticides designed to be as modular as possible, enabling the development and/or modification of any of the individual tasks. This project helps farming sector for developing through advance technologies.

***Key Words*:** agriculture rover, spraying, camera, monitoring, technologies

1.INTRODUCTION

India is agriculture economy and most of rural populations depend on agriculture to earn their livelihood. The farming methods at present are manual or semi-automatic with high involvement of laborer's. In the recent years, the number of labor availability is reducing continuously along with increase in their wages. There is a requirement of higher productivity. Hence the device is to be designed which helps farmers to overcome the stated problem .Automated Robots can provide us the solution .The main application of robots in the commercial sector has been concerned with the substitution of manual human labor by robots or mechanized systems to make the work more time efficient, accurate, uniform and less costly. One may argue the social implications of such developments, for example, the effects on employment through loss of blue-collar jobs to the more efficient robotic counterpart; there are also ethical considerations that may be argued.

Whilst there may well be some validity to the argument in some cases, this current project is unique in the number of stakeholders that are affected in a positive sense. The farmers benefits are found in more efficient maintenance of the crops and either less work for themselves or a decreased need for the employment of others (arguably, an expensive process). Increased demand on growers has begun to be met with increased specific automation in many fields, as producers believe that automation is a viable and sometimes necessary method to ensure maximum profits with minimum costs. Indeed, Hopkins argues that automation enables the expansion of a farm without having to invest more financial resources on labor. Merchants may benefit from increased sales due to a lower cost product the consumers will benefit, likewise, from a lower cost product of comparable quality. The stakeholders that benefit most, at least from an ethical or social perspective, however, are the farm workers. This project presents the design and construction of an autonomous robot that seeks to address some of the human health concerns associated with farms. This robot is designed as abase for developing systems to enable the automation of farming processes such as the spraying of pesticides designed to be as modular as possible, enabling the development and/or modification of any of the individual tasks.

Agriculture has played a major role in the development of human civilization. The agriculture sector has brought out a fundamental and vibrant change in the world socio-economic situation. Indian economy is long known as an agricultural economy, considering that the country has a rich history of agricultural practice. The agricultural rover is an electric vehicle which solve the agricultural problems. We have designed the machine keeping in mind the literacy rates of small scale farmers.

2. PROBLEM DEFINITION

Currently farmers are using hand-held sprayers for sprinkling of pesticides which are harmful for the human health. Rovers are comfortable for spraying the pesticides on the agriculture crops and existing technology is available .The farm labor is extensive and is costly so the rover can reduce the cost of labor. The hand-held pump take large amount of time and is tiresome work as the farmer have to spend hours on the farm.

3. BLOCK DIAGRAM OF THE PROJECT

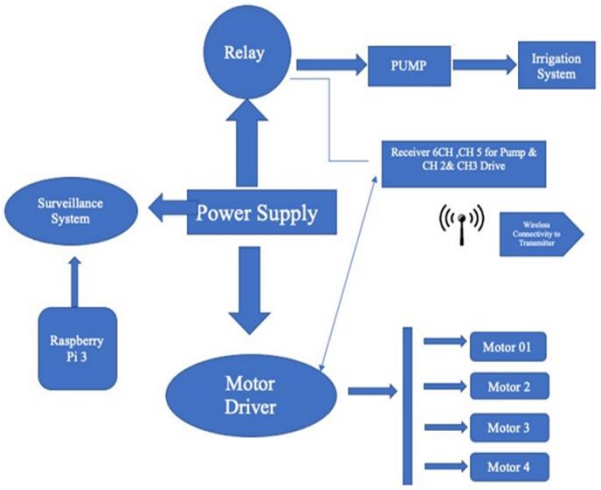

Fig -1: Block diagram of the project

4. CIRCUIT DIAGRAM OF THE PROJECT

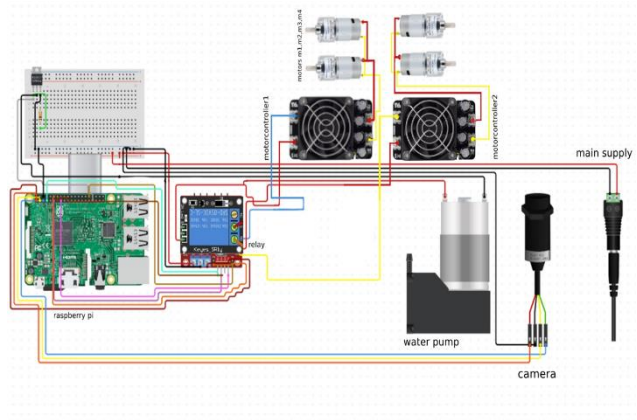

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Fig -2: Circuit diagram of the project

5. COMPONENTS

1) Raspberry Pi 3 B :

This controller is used for the operation of camera
It has following specifications :
Quad Core 1.2GHz Broadcom BCM2837 64bit CPU
BCM43438 wireless LAN
CSI camera port for connecting a Raspberry Pi camera
Micro SD card with Raspberry Pi OS installed
1GB RAM
Weight : 42g
4 USB 2.0 ports
Bluetooth 4.1
Bluetooth Low Energy (BLE)
Full size HDMI
Micro USB power supply (2.1 A)
Supply 5V
Operates at 3.3 V logic level
Idle State requirements : 260 mA (1.4 W)

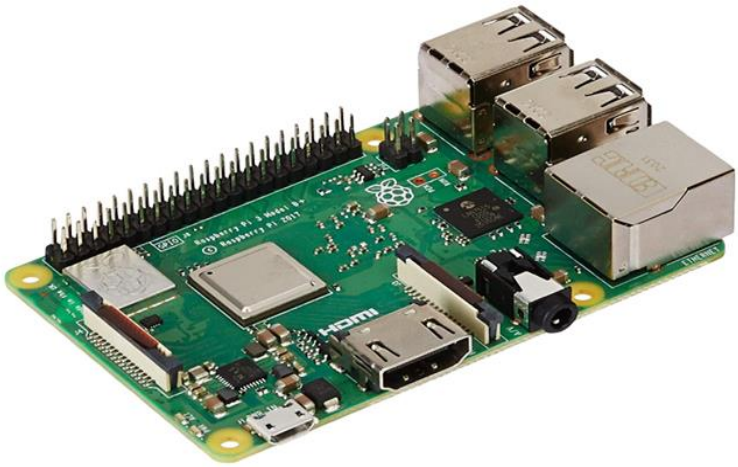

Fig -3: Raspberry Pi

2)APO-M2 ESC- Motor speed controller

Bidirectional DC motor driver
Cooling method: automatic forced air cooling
Size:L:97 mm x W:60 mm x H: 60mm
Operating voltage: 18V to 48V
Standby current :< 40 mA
Max supply current: 80 A
Wattage : 19 W
Weight: 240 g

Fig -4: Motor speed controller

3)DC Motors

A DC motor is any of a class of rotary electrical machines that converts direct current electrical energy into mechanical energy.

Model : XD-37GB520
DC supply: 24 V
Rated Current : 30[0 mA
RPM: 200 at 12V
Shaft diameter: 6mm
Shaft length:15mm
Motor size: 37*58mm
Rated Torque: 3.9 kg-cm
Stall Torque: 15.6 kg-cm
Power : 7 W
Gearbox Dimensions: 22×37 (LxW) mm
Gear ratio : 24:1

Fig -5: DC Motors

4)Battery

Model : GAONENG GNB 6S 22.2V 4000mAh 70C LiPo Battery XT60

Detail Specifications
Model No.: GNB40006S70A
Capacity: 4000mAh
Voltage: 22.2V
Cells Configuration: 6S1P
Pack Dimension: 39*43*140mm (H*W*L)
Net Weight: 495g
Discharge Rate: 70C
Charge Rate: 1C to 5C
Discharge Connector: XT60

Fig -6: Battery

5)Relay

SRD-05VDC-SL-C

Relay is a type of switch that we used for Operating Pump.

A single-channel relay is an electronic switch that can be controlled by a low-power electrical signal

1CH Relay Module
Relay contact current capacity:DC5V;10A
Operating Voltage : 5v
Current requirement : 85mA

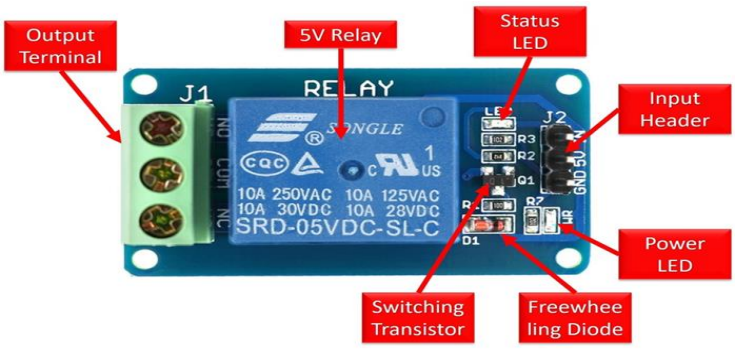

Fig -7: Relay

6)Pipe

Usage/Application	RO Pipe
Material	Polyethylene
Color	Blue
Roll Length	2m
Diameter	6mm
Internal diameter	4mm

7) Pump

1. BPump used in project is Diaphragm Pump
Operating voltage : 12v dc
Current rating : 2A
Maximum pressure : 0.48MPa

Flow rate : 3.5 L/Min
Cable length : 28cm
Weight : 480g
Power : 19 W

Fig -8: Pump

8) Mist nozzle

- A misting system typically consists of several nozzles
- We have mounted the nozzles on an PVC pipe of upside down [U] shaped assembly
- These nozzles are connected to high-pressure Diaphragm Pump which force water through them, resulting in the formation of droplets.
- Mist nozzle Orifice size : 0.15 mm
- Pressure (max): 0.4 MPa

CONCLUSION

With a somewhat low running cost, the prototype provided a reasonable rate of area coverage. The technology fully eliminates handling of dangerous chemicals and heavy effort by the farmer since it can be managed remotely, addressing the issue of a lack of agricultural labor and ensuring safe agricultural practices.

Small and medium sized farms can use the suggested spraying robot. The spraying unit will be produced on a large scale, which will cut costs greatly and help Indian agricultural practices in several ways. Depending on the need, the unit may be scaled up. The created system may be used to irrigate lawns, spray insecticides, fungicides, and fertilizer. Farmers' workloads may be reduced, which will also result in fewer health issues.

The robot can move over difficult, uneven ground and can carry a sufficient weight of equipment, including a pump.

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BIOGRAPHIES

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