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Agribot for Polyculture and Crop Monitoring

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Abstract: Automation robot is used in many of the fields such as defense, surveillance, medical field, industries and so on. This paper mainly deals with polyculture where moisture and temperature are the important parameters considered. The threshold level for moisture and temperature for each soil is predetermined by taking samples of around three soil types (clay soil, black soil, and alluvial soil). In this system, the soil moisture sensor is interfaced with the Raspberry Pi, the sensor will sense the data and it will pass the information to Raspberry Pi so that it will ON/OFF the DC motor to irrigate automatically. A webpage is created to give instructions to the robot to move forward and backward which also enables the user to get live video streaming from the farmland via the webcam.
Keywords: Raspberry Pi (Wireless fidelity, Wi-Fi, Soil moisture sensor, Webcam, IOT.

I. INTRODUCTION

The agriculture is the main scenario in our day to day life. In India, 70% of people are dependent on agriculture. But its value is decreasing day by day due to various reasons. In the current generation, most of the countries do not have sufficient human factor in the agricultural sector and it affects the growth of developing countries. We all must understand that without farmer there is no food and without food, there is no survival.

As season changes, there is a fluctuation in the production of food grains. Also, agricultural advancements and practices differ globally since plants have their own characteristics and the location where they develop plays a vital role. Farming is the most primitive jobs and IT related being the most advanced and modern. Farming is essential for life maintenance on mother earth and it is important in IT sector to get better farming results.

IT supports precision agriculture like automatic machinery that sprays fertilizers and for irrigational facilities. The Internet has been a great tool for better communication to establish these functionalities. A method of farming which is based on observing and measuring and responding to inter and intra field in variability in crops is called as "Satellite Farming" or "Site-Specific Crop Management" (SSCM).

The rest of the paper is organized as follows: Section II describes the existing systems. Section III provides an overview of the proposed system. The practical implementation of the system is described in Section IV. The block diagram is presented in Section V. Related works and conclusions are presented in Section VI and VII respectively.

II. EXISTING SYSTEMS

In the existing system, we have a microcontroller and sensor which monitors the water level in the crop field. The sensor used is the automated unit which will cut the unwanted crops. This system should be controlled manually to move forward and backward.

Another existing system is the lab view based agriculture. Here, the robot is controlled by sending commands through a personal computer. This system can't be carried everywhere, as it is not compact. The robot control section is not easy and the only single task can be done by this robot.

III. PROPOSED SYSTEM

This robot system is used to develop the process of cultivating agricultural land without the use of manpower. This system reduces the time and increases the productivity rate. The proposed system consists of web camera which is fixed on the robotic setup that will continuously monitor the crops. The soil moisture sensor is interfaced with the Raspberry Pi so that it will ON/OFF the DC motor to irrigate automatically.

The robot can be controlled through the web page. Just giving an instruction on a web page the robot will move according to the directions and also provides live streaming from the farmland via webcam. The value of temperature and soil moisture is displayed in the LCD. Three types of soils (black, alluvial, clay) are taken. Two crops for soil type is taken. The threshold values for temperature and soil moisture is determined by taking samples.

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IV. PRACTICAL IMPLEMENTATION

This system comprises of Raspberry Pi, Soil moisture sensor, the Temperature sensor (LM35), Engine driver unit (LM293D), Switched-Mode Power Supply, DC motor, 2 channel Relay, Transistor-Transistor Logic, Webcam.

A. Raspberry Pi

The third generation Raspberry Pi is Raspberry model 3 B. This is the board which we are making use of since it has a port for wireless LAN connectivity. It runs on a 64-bit Quad core Broadcom 2837 processor and has an operating frequency of 1.2GHz. It is ten times faster than first generation Raspberry Pi models. It supports various functionalities using its 40-general purpose input and output pins. It is through these pins the signal from IR sensor and signal to the engine driver unit are sent. It is programmed using python IDLE. The board is powered by AC-to-DC adapter or SMPS to get started. 15-pin MIPI camera interface (CSI) connector, used with the Raspberry Pi camera or Raspberry Pi NoIR camera. The video controller has higher resolutions, such as, up to 2048×1152. The webcam can be easily interfaced in Raspberry Pi.

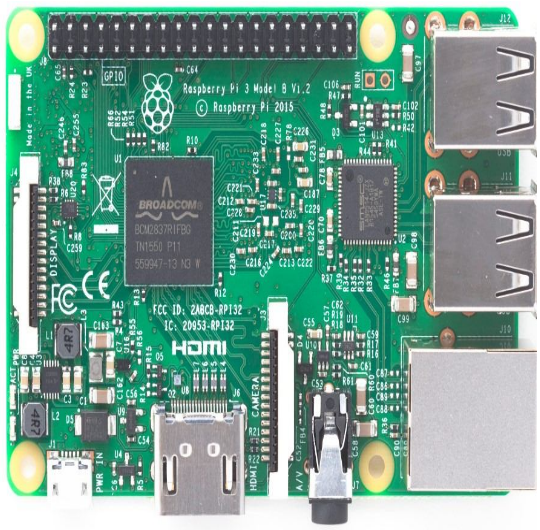

Fig 1: Raspberry Pi Board

B. Engine Driver Unit

DC motor is controlled by the Raspberry Pi. Engine driver unit act as a bridge between the processor and the DC motor. It is an HB Bridge motor control circuit which is formed using LM293D. The LM293D is a 16 pin IC. Each motor requires two wires from LM293D.

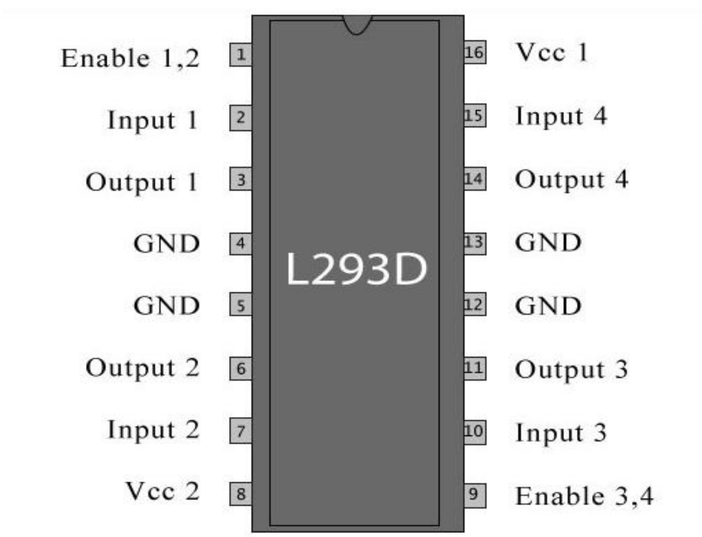

Fig 2: LM293D Pin Diagram

C. Soil Moisture Sensor

Soil moisture sensors measure the water content in the soil. The measurement depends on the environmental factors such as soil type, temperature or electric conductivity. Soil moisture affects reflected microwave radiation and it is used for remote sensing and agriculture. Soil moisture measurements are important for agricultural applications which help farmers to manage their irrigation systems more efficiently and effectively. Knowing the exact soil moisture conditions on their fields, not only farmers are able to use less water, they are also able to increase the yields and the quality of the crop by improved management of soil moisture during critical plant growth stages

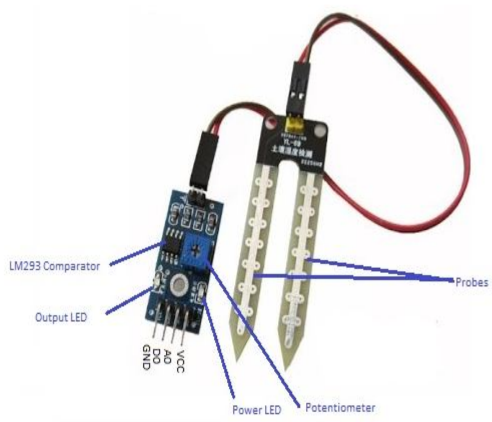

Fig 3: Soil Moisture Sensor

D. Temperature Sensor

The temperature sensor is used to measure the hotness or coldness of an object. LM35 is a precision IC temperature sensor which has its output proportional to the temperature. The temperature measured inLM35 is more accurate than with the thermistor. The operating temperature range is from -55 to 150 degree Celsius.

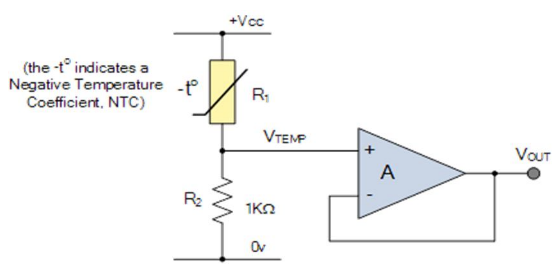

Fig 4: Temperature Sensor

E. Working

Raspberry Pi is the main component used in our system. The power is supplied by means of SMPS. 12 Volts from SMPS is passed to the Relay and Regulator 7805 which gives an output of 5 Volts. Motor driver (LM293D) consists of two inputs and it can drive two motors.

INPUT 1	INPUT 2	DIRECTION OF ROTATION
0	1	Anti-clockwise
1	0	Clockwise

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The soil moisture sensor is interfaced with the Raspberry Pi. The sensor will sense the data and pass the information to the Raspberry Pi so that it will ON/OFF the Dc motor to irrigate automatically. The main advantage of using Raspberry Pi is that it consists of inbuilt Wi-Fi module. The IP address of the robotic setup and the user device must be synchronized. A webcam is used which gives a live video streaming happening in the field. A keypad is available in the robot where we can change the threshold values whenever needed. User interface buttons are available which enables the user to move the robot forward and backward.
As mentioned above, three soil types are taken as samples where the temperature and moisture are considered as the important parameters. The irrigation process mainly focuses on the threshold values of temperature and moisture. Temperature and moisture are inversely proportional to each other.(i.e):

A. Moisture decreases, temperature increases => crops must be irrigated.
B. Moisture increases, temperature decreases => there is no necessity of irrigating the crops.

The values of the moisture and temperature are displayed in LCD.

V. BLOCK DIAGRAM

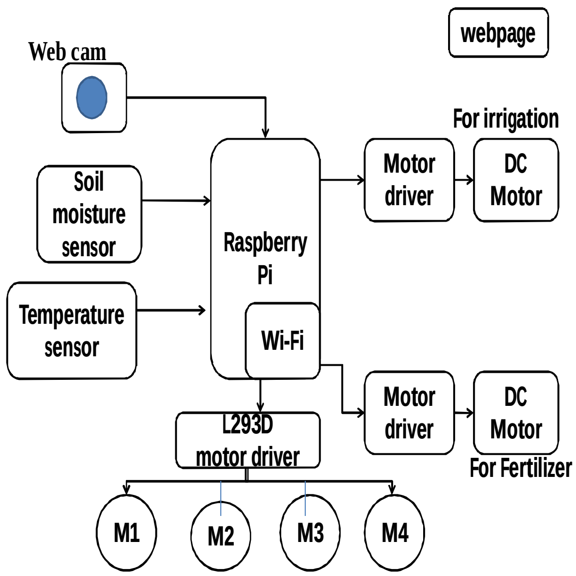

Fig 5: Block Diagram Of Agribot for Polyculture and Crop Monitoring

VI. RELATED WORKS

A. Design Of Lightweight, Modular Robotic Vehicle For The Sustainable Intensification Of Broadacre Agriculture [1]

This paper describes a lightweight, modular and energy efficient robotic vehicle platform designed for broadacre agriculture – the Small Robotic Farm Vehicle (SRFV). SRFV is designed to promote the sustainable intensification of agriculture by allowing farmers to concentrate more on-farm management tasks.

B. Autonomous Sweet Pepper Harvesting For Protected Cropping Systems [2]

This paper presents a new robotic harvester (Harvey) that can autonomously harvest sweet pepper in protected cropping environments. This approach combines effective vision algorithms with a novel end – effector design to enable successful harvesting of sweet pepper.

C. Plant Classification System For Crop/Weed Discrimination Without Segmentation [3]

This paper proposes the machine vision approach for plant classification without segmentation. This system can discriminate crop and weed plants growing in commercial fields where crop and weed grow close together and handles overlap between plants.

D. A Crop/Weed Field Image Dataset For The Evaluation Of Computer Vision Based Precision Agriculture Tasks [6]

This paper proposes a benchmark dataset for crop/weed discrimination, single plant phenotyping and other open computer vision tasks in precision agriculture. The dataset comprises 60 images with annotations. For every dataset image, a ground truth vegetation segmentation mask and manual annotation of a plant type are supplied.

VII. CONCLUSION

"The value of agriculture can be understood when each and every person thinks of the person, who planted the tree while eating the fruit" ;"Investments in agriculture are the best weapons against hunger and poverty and they have made life better for billions of people" these quotes tell the importance of both agriculture and farmers. Thus our system will be of great use to the farmers. It helps the farmers to view their lands from any part of the world by getting live video streaming from the fields. Any part of the field can also be viewed by the farmer with the help of user interface buttons. The designed system can further be enhanced to work efficiently and effectively and to cover a larger area. This system reduces manpower and increases productivity. As farmers are the backbone of our country, our system will help the farmers in a good way.

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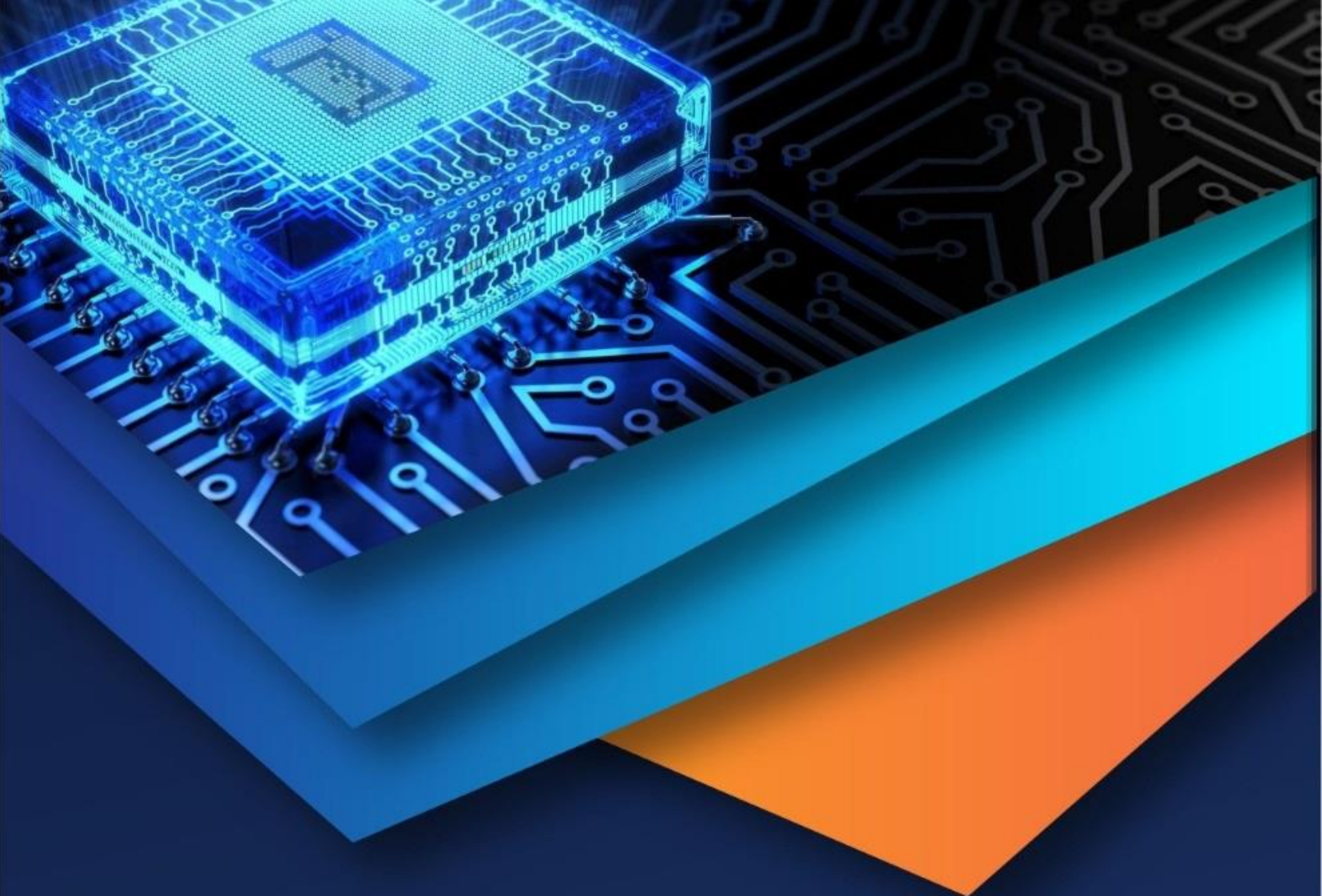

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