Design and Implementation of Semi-Autonomous Water Pumping Seed Sowing and Insect Repellent Mobile Robot

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Abstract

In this project, Agriculture is the backbone of Indian economy. Robotics is a promising technology that contributes to all over sector from medical to space study. One sector is lags behind is the agriculture. More robots and devices are introduced for the plants healthy condition and to achieve full life cycle without any chemical effects to human and environment. To improve low cost mobile robotic system and to perform the following actions like water pumping, insect repellent mechanism and automatic seed sowing mechanism. Some sensors which is exactly suitable for agriculture that are build with Raspberry Pi 3. Spot for seed sowing and buzzer sound is specified by Ultrasonic Sensor. Soil Moisture Sensor is used to senses whether the soil is wet or dry. These all operation can be done without any human intervention.

Index Terms – *Raspberry Pi 3, Soil Moisture Sensor, Ultrasonic Sensor, Robot, Water pumping.*

1. INTRODUCTION

Automated agriculture task brings more benefits to the field which ignore unexpected or dangerous effects of chemical exposure which also helps to gain all over efficiency and productivity. Nearly, 70% of the people in India depends on agriculture. Our innovative ideas are to automate the process of water pumping and sowing seeds like corn, green peas, and vegetables like beans, lady's finger, seed of wheat etc. The seed sowing, water pumping, wheels is automatically done by using DC motor. Soil Moisture Sensor are used to sense the moisture and content in the soil and the presence of obstacles detects the buzzer sound with the help of Ultrasonic sensor. Several varieties of traditional irrigation system that are followed from the past. For instance, water starts to flow down the channel automatically when it is connected to tank or reservoir. The water is distributed through a of pipes and then it is spread into air using sprinkler so that it breaks up into small droplets of water that fall into the ground. All this type of irrigation is mostly used in plain areas.

2. LITERATURE SURVEY

In the year 2014, Joaquin Gutierrez, Alejandra Nieto-Garibay, "Automated Irrigation System Using a Wireless Sensor Network and GPRS Module", which describes an automated irrigation system was developed to optimize water use for agricultural crops. The system has a distributed wireless network of soil-moisture and temperature sensors placed in the root zone of the plants. In addition, a gateway unit handles sensor information, triggers actuators, and transmits data to a web application. The automated system was tested in a sage crop field for 136 days and water savings of up to 90% compared with traditional irrigation practices of the agricultural zone were achieved. Three replicas of the automated system are formed using successfully in other places for 18 months. Because of its energy autonomy and low cost, the system has the potential to be

useful in water limited geographically isolated areas.

Joaquin Gutierrez, Miguel Angel Porta-Gandara, "An Automatic Irrigation System using ZigBee in Wireless Sensor Network", Wireless Sensing Technology is widely used everywhere in the current scientific world. As the technology is growing and changing rapidly, Wireless sensing Network (WSN) helps to upgrade the technology. In the research field of wireless sensor networks the power efficient time is a major issue. Then problem can be overcome by using the ZigBee technology.

Yandong Zhao, Junfu Zhang, Weilun Yin, "Study on Precision Water-saving Irrigation Automatic Control System by Plant Physiology", Precision water-saving irrigation automatic control system by plant physiology

to described is one of the Olympic Games facilities projects, which takes standards of water plant physiologically need and soil water content as the basis. On this basis, the system monitors by GSM remote wireless communication make all irrigation incidents automatically enter into the database. To describes system structure on two aspects of hardware and software design, it is characterized by a flexible mode of operation, reliable control and data transmission, low-cost, remarkable water-saving effect.

3. PROPOSED DESIGN

In the proposed design, vision-based seed sowing system is introduced. Visio based system can be achieved by using camera. Robots after finding the edges it can sow the seeds. Spot for seed sowing can be provided by Ultrasonic. Soil moisture level, Ultrasonic sensor value and other parameter value are sent to IoT cloud.

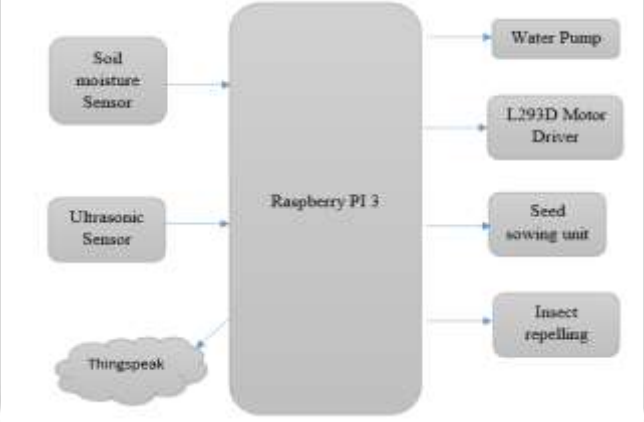

Fig. 1 Block diagram of design and implementation of semi – autonomous water pumping seed sowing and insect repellent mobile robot

3.1 RASPBERRY PI 3

Raspberry Pi 3 is a third generation Raspberry Pi. It is 10X faster than the first-generation Raspberry Pi. Raspberry Pi 3 Model B brings a more powerful processor. Additionally, it adds wireless LAN and Bluetooth connectivity.

3.2 SOIL MOISTURE SENSOR

Soil Moisture sensor uses capacitance to measure dielectric permittivity. The sensor uses two probes to pass current through the soil, and then it reads that resistance to get the moisture level. The sensor is immersed in the soil. Wet soil conducts more electricity, which means there will be less resistance and vice versa. When the moisture level is high, then the LED will glow. The sensor gets connected with comparator in order to get the digital output.

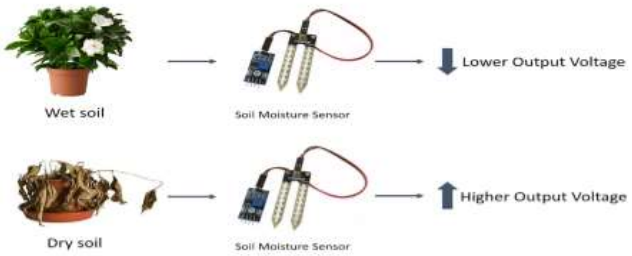

Fig. 2 Example of Soil Moisture Sensor

3.3 ULTRASONIC SENSOR

An Ultrasonic sensor is a device that can measure the distance of an object by using sound waves. It measures distance by sending out a sound wave at a specific frequency and listening for that sound wave to bounce back. It emits an ultrasound wave at the frequency of 40KHz in the air. HCSR04 module generates a sound vibration in ultrasonic range when we make the 'Trigger' pin high for about 10us which will send an 8-cycle sonic burst at the speed of sound and after striking the object, it will be received by the Echo pin. And if the obstacle is near, then the ECHO will be heard faster and output pulse width will be smaller.

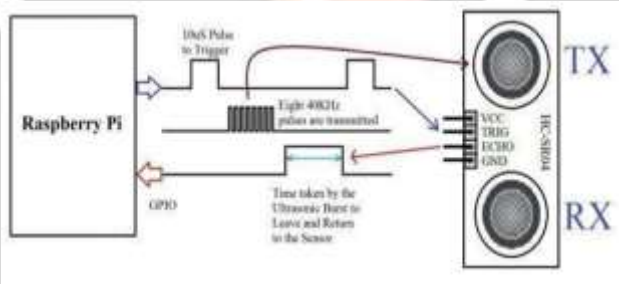

Fig. 3 Working of Ultrasonic Sensor

3.4 L293D MOTOR DRIVER

L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC Motor. To provide bidirectional drive designed currents of up to 600-mA. There are 4 input pins for L293d, pin 2, 7 on the left and pin 15 ,10 on the right. Left input pins will regulate the rotation of motor connected across left side and right input for motor on the right-hand side. The motors are rotated on the basis of the inputs provided across the input pins as LOGIC 0 or LOGIC To provide Logic 0 or 1 across the input pins for rotating the motor

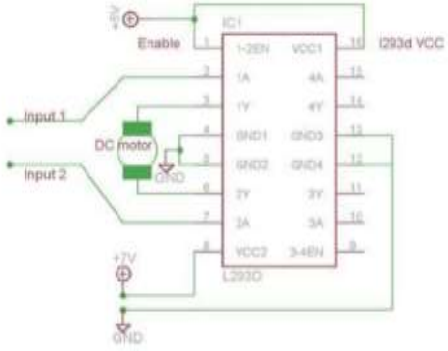

Fig. 4 Working of L293D Motor Driver

3.5 SEED STORAGE TANK

Design according to the wait sustained by the robot as well the required capacity for planting. To the bottom of the tank seed sowing disk is arranged. The disc serves the function of distribution of the seeds, has for each complete rotation of the rotating wheel, only one seed falls from the tank. Hence plating is done smoothly and accurately.

3.6 WATER PUMPING

When the soil is dry, automatically water gets pump through tank reservoir.

3.7 INSECT REPELLENT UNIT

Environmentally friendly insect's repellent for agriculture. The insect's repellent has been shown economically harmless and bio degradable. If any obstacles detected it will receive the ECHO signal to measure distance form sensor to the obstacles through buzzer sound.

3.8 THINKSPEAK

ThingSpeak is an IoT analytics platform service that allows you to aggregate, visualize and analyse live data streams in the cloud. Thing Speak provides instant visualizations of data
posted by your devices to Thing Speak. Thing Speak is often used for prototyping and proof of concept IoT systems that require analytics. Send sensor data privately to the cloud. Sensors detect and measure information on all sorts of things like moisture, ultrasonic, temperature and pressure.

3.9 OPENCV

OpenCV was started at Intel in 1999 by Gary Brodsky and the first release came out in 2000. Vadim Picaresque joined Gary Brodsky to manage Intel's Russian software OpenCV team. Currently OpenCV supports a wide variety of programming languages like C++, Python, Java etc. and is available on different platforms including Windows, Linux, OS X, Android, iOS etc.

4. RESULTS AND DISCUSSIONS

The results of the project are shown in this chapter whether the soil is wet or dry and the obstacles are detected by using the Ultrasonic Sensor are plotted in the graph using ThinkSpeak. The output will show in the graph and run the python program output will be displayed.

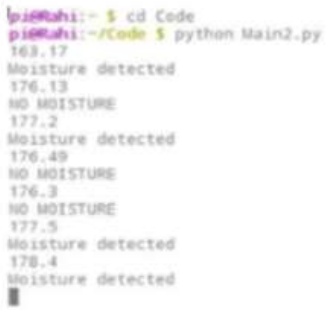

Fig. 5 Soil Moisture Sensor Result

The Fig. 5 shows the result of moisture sensor whether the soil is wet or dry.

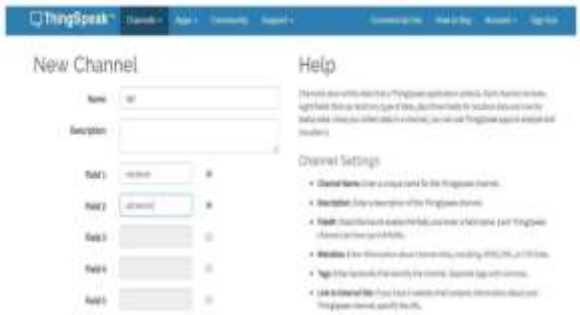

Fig. 6 Channel Setting of Field

The Fig. 6 is the channel setting to know the moisture sensor and ultrasonic sensor detail and graph is plotted as shown in the Fig. 7 and Fig. 8.

Fig. 7 The graph field 1 chart is for Soil Moisture Sensor

Fig. 8 The graph field 2 chart is for Ultrasonic Sensor

Fig. 9 Camera Serial Interface to capture image

The frame processing will be a little bit slow when compared to USB camera. The mobile camera should be connected with the same network at which the Raspberry Pi3 is connected so that it acts as Local IP to work on IP camera.

5. CONCLUSION

The final conclusion of project is a fully autonomous robot by adding camera and various sensors as Soil Moisture sensor, inertial measure units, to have better approach for agricultural applications. It is equipped with various sensors to monitor different environmental parameters that are suitable for crop yield. Monitoring of crops wirelessly allows reducing labor costs and also helps to track the changes accurately occurring instantly in real time at the field. The proposed system is capable of controlling the essential parameters necessary for plant growth. So this proposed smart agricultural system of farming is user friendly and highly robust. So, it will be able to spray given location without any human interaction and control. Data transfer will be achieved by wireless communication.

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