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AUTOMATIC COTTON PLUCKING ROBOT USING IMAGE PROCESSING

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Abstract - Agricultural sector is desperately in need of engineering outcomes like Automation, Information Technology and more recently Robotic Technology. Cotton Cultivation in India occupying an enormous share in commercial crops is facing a serious problem of picking the cotton from the plants by the labor because the labor costs are increasing lately. This paper aims at achieving a prominent solution with the utilization of Machine vision alongside Image Processing and Microcontrollers for identification, recognition, and processing of the cotton image intrinsically and picking the cotton with robotic arms to yield maximum production during a day per hectare. Research and development in perceptual system for robots enabled the agricultural sector to catch hold of the technology in reducing the general cost. These intelligent robots use sort of visual sensors to detect objects with reference to their identity, position, color, orientation in 3D pattern at the fields. This paper also proposes at the new algorithms in Image processing of the cotton to extract the feature, modeling and matching. These are AI for Robotic Vision, Image Processing for Segmentation, feature measurement like invariants, size and shape, texture and scene analysis and controlling the robotic arms in desired angle.

Key Words: Robot

1. INTRODUCTION

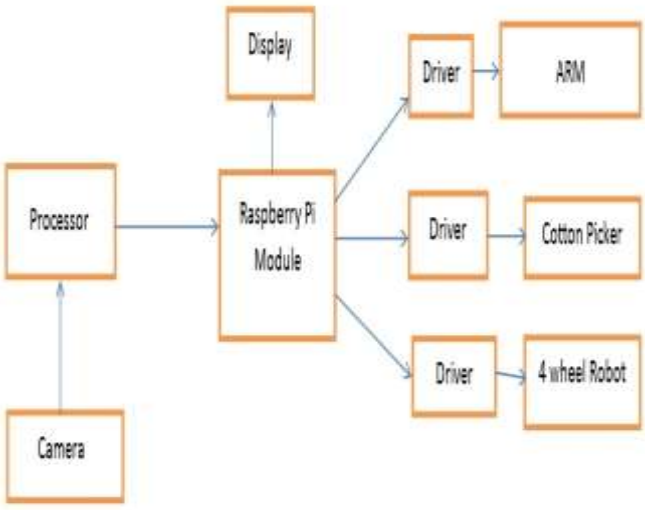
Cotton is most vital commodity in world and it's cultivated by large areas in India. Cotton picking is completed mostly by hands in India primarily by women. Cotton is picked from cotton ball by human hands. Generally workers attend field within the morning to start out picking and continuously work till evening. Generally a white open flower takes 50-55 days to develop to the stage where white and harvestable lint is showing. Higher heat accelerated the cotton ball maturity level but doesn't end in genetic improvement .So we aim to utilize the best knowledge of science to style such efficient machine which may do perform add field and reduces human efforts. This machine pick cotton in farm and can reduce the surplus man power required while cotton harvesting. As extra money is required in farm for labor work and the harvesting of cotton is performed in some intervals of your time. This makes small scale farmers to spend money on the labor for harvesting. Therefore this machine will save the cash of small scale farmers; it'll reduce the trouble required will performing the picking operations.

Cotton is one of the important commercial crops in India occupying the first place in cultivated area and the second biggest crop production of the world. There is so much conventional procedure and heavy requirement of labor with cotton picking. It is high time to make the automation of cotton picking aboard. During mature period, thousands of workers are to be employed from other regions so that cost of cotton picking increasing day by day. The delay in picking time critically influences both the quality of cotton and the quantity. Weather uncertainty like sudden rains, is also a major factor which decides the maximum useful cotton production. Though mechanization of cotton picking including advanced cotton pickers in USA and EUROPE and other cotton picking tools, have already been existing but they resulted in unsatisfied yield due to high cost and problems in importing such huge machines by the low income farmers in India. Also due to the low quality level of the picked cotton, the old method of hand picking is still being adopted. In particular, Machine picks more rows of plant at a time. It uses gasoline as a fuel. These machines reduced dependence on labor.

2. OBJECTIVES

Cotton Plucker robot detects the presence of cotton and captures the image of it. On getting signal from farmer robot plucks the cotton from the sector. Simultaneously it detects the moisture content within the soil.

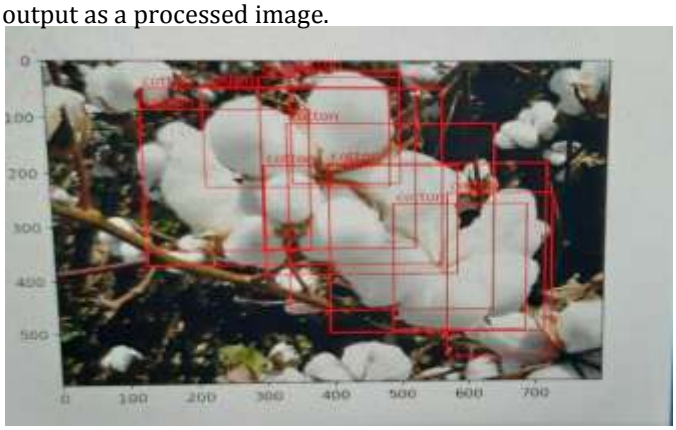
3. BLOCK DIAGRAM



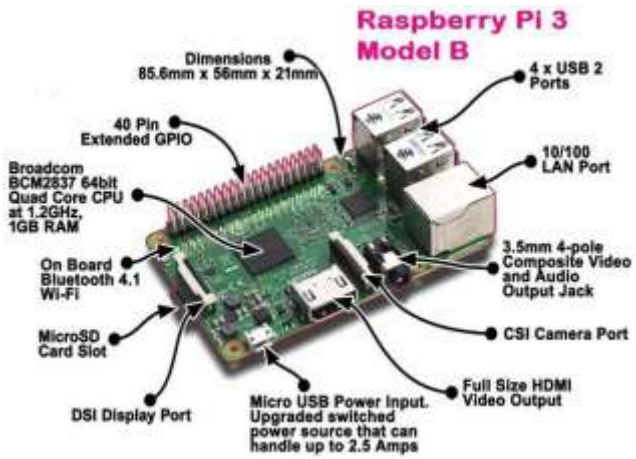
4. COMPONENTS

a. IMAGE PROCESSING :

In every harvesting position, the camera collects an image. In general, any digital image processing algorithm consists of 3 stages: input, processor, and output. In input stage image is captured by the camera. It is sent to a particular system to focus on a pixel of image that's gives, its output as a processed image.



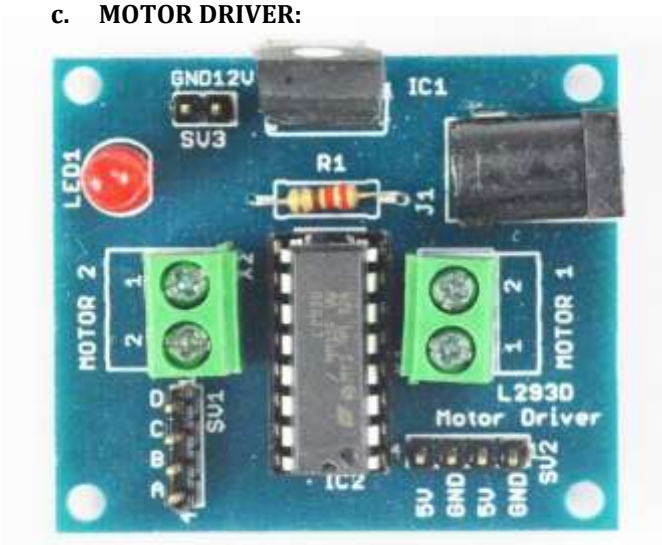
b. RASPBERRY PI:



- 256 MB SDRAM memory
- Single 2.0 USB connector
- Dual Core Video Core IV Multimedia coprocessor
- HDMI (rev 1.3 & 1.4) Composite RCA (PAL and NTSC) Video Out
- 3.5 MM Jack, HDMI, Audio Out
- SD, MMC, SDIO Card slot on board storage
- Linux Operating system
- Broadcom BCM2835 SoC full HD multimedia processor
- 8.6cm*5.4cm*1.5cm dimensions

The Raspberry Pi 3 Model B is that the latest version of the Raspberry Pi computer. The Pi is different from your typical machine, in its cheapest form it doesn't have a case, and is just a credit-card sized electronic board -- of the sort you would possibly find inside a PC or laptop but much smaller. The Pi 3 can be used as a budget desktop, media center, retro games console, or router for starters. However that's just the tip of the iceberg. There are many projects out there, where people have used the Pi to create tablets, laptops, phones, robots, smart mirrors, to require pictures on the sting of space, to run experiments on the International space platform. The quad-core Raspberry Pi 3 is both faster and more capable than its predecessor, the Raspberry Pi 2. For those curious about benchmarks, the Pi 3's CPU--the board's main processor--has roughly 50-60 percent better performance in 32-bit mode than that of the Pi 2, and is 10x faster than the first single-core Raspberry Pi (based on a multi-threaded CPU benchmark in Sys-Bench). Compared to the first Pi, real-world applications will see a performance increase of between 2.5x--for single-threaded applications--and quite 20x--when video playback is accelerated by the chip's NEON engine. Unlike its predecessor, the new board is capable of playing 1080p MP4 video at 60 frames per second (with a bit-rate of about 5400Kbps), boosting the Pi's media center credentials. That's to not say, however, that each one video will playback this smoothly, with performance hooked in to the source video, the player used and bit-rate. The Pi 3 also supports wireless internet out of the box, with built-in Wi-Fi and Bluetooth. The latest board also can boot directly from a USB-attached disk drive or pen drive, also as supporting booting from a network-attached filing system, using PXE, which is beneficial for remotely updating a Pi and for sharing an OS image between multiple machines.

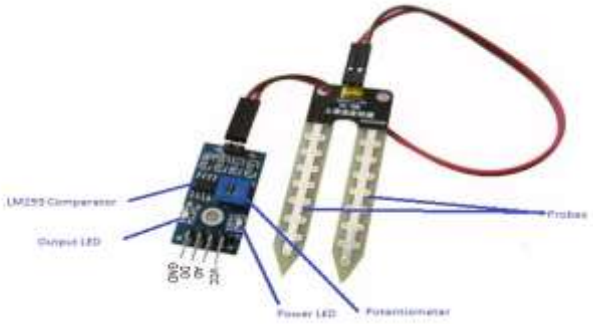
c. MOTOR DRIVER:



L293D may be a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. L293D may be a 16-pin IC which may control a group of two DC motors simultaneously in any direction. It means you'll control two DC motor with one L293D IC.

It works on the concept of H-bridge. H-bridge may be a circuit which allows the voltage to be flown in either direction. As you recognize voltage got to change its direction for having the ability to rotate the motor in clockwise or anticlockwise direction, Hence H-bridge IC are ideal for driving a DC motor. In a single L293D chip there are two h-Bridge circuit inside the IC which may rotate two dc motor independently. Due its size it's considerably utilized in robotic application for controlling DC motors. Given below is that the pin diagram of a L293D motor controller. There are 4 input pins for l293d, pin 2 ,7 on the left and pin 15 ,10 on the proper as shown on the pin diagram. Left input pins will regulate the rotation of motor connected across left side and right input for motor on the proper hand side. The motors are rotated on the idea of the inputs provided across the input pins as LOGIC 0 or LOGIC 1.

d. MOISTURE SENSOR:



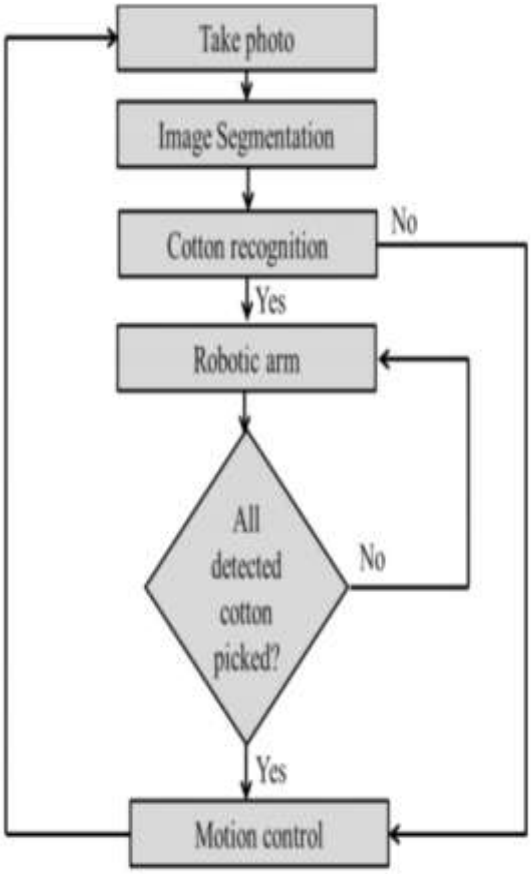
Specifications:

- Working Voltage: 5V
- Working Current: <20mA
- Interface type: Analog
- Working Temperature: 10℃~30℃

The Moisture sensor is employed to live the water content (moisture) of soil. When the soil has water shortage, the module output is at high level; else the output is at low level. This sensor reminds the user to water their plants and also monitors the moisture content of soil. It has been widely utilized in agriculture, land irrigation and botanical gardening. The sensor creates a voltage proportional to the dielectric permittivity, and thus the water content of the soil. The sensor averages the water content over the whole length of the sensor. There is a 2 cm zone of influence with reference to the flat surface of the sensor, but it's little or no sensitivity at the acute edges. The Soil Moisture Sensor is employed to live the loss of moisture over time thanks to evaporation and plant uptake, evaluate optimum soil moisture contents for various species of plants, monitor soil moisture content to regulate irrigation in greenhouses and enhance bottle biology experiments.

e. ROBOTIC ARM:

5. FLOWCHART:



6. WORKING

This project aims at achieving a prominent solution with the use of Machine vision together with ***Image Processing*** for identification, recognition, and processing of the cotton image as such and plucking the cotton with robotic arms to yield maximum production. The benefits of the proposed project is to achieve better efficiency in water usage compared to manual irrigation, achieved via direct soil moisture and humidity measurements at various

geographical positions in the farm. It is worth noting that the project helps to irrigate the farm, not based on a single point data like in the automated systems, but irrigates based on averaged data obtained at each point. The data collected at various geographical points at various times in a day are transmitted to the cloud. Hence historical data is available over the entire farm under supervision, which by appropriate analytic can be used for prediction of future data.

7. SOCIAL IMPACTS

There is a great deal of societal concern about the use of robots in replacing human labor and creating employment crisis across many disciplines, not just agriculture. In the case of labor for cotton harvest where mechanization is already prevalent, the impact on labor requirements will not be significant, as one to two employees are currently all that are needed to harvest approximately 2000 acres per year. However, in parts of the world such as eastern China and much of India where cotton is still hand harvested, the impacts on farm labor are of more concern. Some lessons learned from the first wave of cotton harvest mechanization could help inform how robotic harvest may impact hand-harvested areas of the world.

8. ADVANTAGES

- Increased soil compaction could be eliminated at harvest.
- Leaf and bract trash in the seed cotton would be significantly reduced allowing faster ginning with less cleaning.
- Labor problem can be reduced.
- Time effective action will be done.
- The existing System will be removed successfully in this automatic machine.

9. POSSIBLE OUTCOMES

- This type of cotton picking machine reduced cotton harvesting time compare to hand picking and less in cost compare to other type of cotton picking machine.
- It reduces the risk of injury.
- Farm can be easily maintained.
- It reduces the labor.
- The cotton picking machine is simple and easy to handle by farmer.

10. CONCLUSION

There are clear benefits from the ability to frequently harvest cotton with a robotic system including fiber quality improvements and reduced risk of yield loss due to weather events. Robotic technologies are evolving quickly. As timing of cultural operations is crucial, mechanization of cotton production is a way to increase productivity, which stands out as the top priority for improving the profitability of cotton production. The machines easy to handle, and it is easy to operate. Also it is of light weight. It will reduce the money required for harvesting process and also reduces the risk of injury. It will provide human comfort while performing the cotton picking operations.

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