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MODELLING, CONTROL & SIMULATION OF AGROBOT

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ABSTRACT

In the present scenario, technology in agricultural sector is eliciting at a rapid pace. In order to meet the human civilization prerequisites and to reduce load on farmers this project deals with the technology driven agrobot which will escalate the ever-growing demands and steadfast the society. Agricultural robotics is the logical proliferation of technology in Bio-systems such as agriculture,forestry, greenhouse etc.

Keywords: agrobot,catia, image processing, remotely, sensors.

I.INTRODUCTION

We have designed the agrobot to be simple, efficient and fast so that it can be applied to real time applications. To approach this,bot is made wireless, so that it can be controlled and monitored by farmers remotely. Thereby with the help of image processing technology, high yield crops are differentiated from low yield ones on the basis of color. It is made to monitor the soil sample and various parameters such as Ph, humidity, temperature are measured. The observed data will then be wireless transmitted to the farmer.

II. MOTIVATION OF THE PROJECT

This idea arose from the problems faced by the farmers such as improper detection of various soil parameters which will affect the production . In achieving this we took help from a research paper presented by Ankit Singh, Abhishek Gupta at(International Journal of Advanced Research in Computer and Communication Engineering-2015). Agrobot is a robot designed for agricultural purposes. This Bot performs basic elementary functions like image processing, soil monitoring, data transmission designed to minimize the labour work of farmers and additionally increasing speed and accuracy.

III. BLOCK DIAGRAM

The Figure [1] shows the block diagram of proposed system which comprises of Arduino acting as a master micro-controller,12V Lipo battery, Xbee s2B pro module-Bridge motor driver, Image Processing Camera ,sensor, dc and servo motor. The proposed system integrates all the functions such as detecting the crop, telling the moisture as well as temperature level, fertilization, monitoring, and control into a single robot that performs these operations while letting the farmer control it remotely.

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A. Actuators

An actuator is a component of a machine that is responsible for moving or controlling a mechanism or system. An actuator requires a control signal and a source of energy. The control signal is relatively low energy and may be electric voltage or current, pneumatic or hydraulic pressure, or even human power.In our system,we are incorporating servo motors and high torque dc motors.

B. Image processing Techniques

There are two types of methods used for image processing namely, analogue and digital image processing. Analogue image processing can be used for the hard copies like printouts and photographs. Image analysts use various fundamentals of interpretation while using these visual techniques.Digital image processing is the use of computer algorithms to perform image processing on digital images. As a subcategory or field of digital signal processing, digital image processing has many advantages over analog image processing. It allows a much wider range of algorithms to be applied to the input data and can avoid problems such as the build-up of noise and signal distortion during processing. Since images are defined over two dimensions (perhaps more) digital image processing may be modeled in the form of multidimensional systems.

C. Wireless Control and Data transmission

Wireless control and data transmission is achieve by using xbee modules.As xbee modules provide bidirectional data transfer so two modules are used which provides simultaneous transmission as well as reception of data.The XBee radios can all be used with the minimum number of connections | power (3.3 V), ground, data in and data out (UART), with other recommended lines being Reset and Sleep. Additionally, most XBee families have some other ow control, in-put/output (I/O), analog-to-digital converter (A/D) and indicator lines built in.

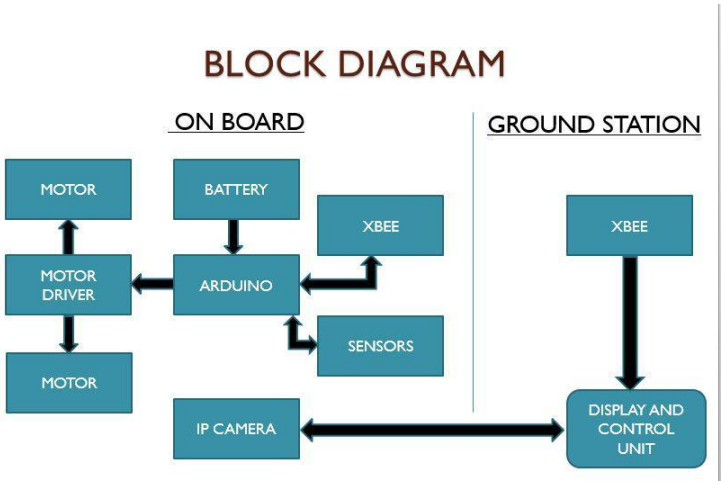

Fig1. Block Diagram of Agrobot

IV. METHODOLOGY

The methodology of this project is based on the simple automation which is achieved with the help of image processing, control and wireless data transmission. As this project deals with robotics field, mechanical designing and simulation are the backbone. For this approach we are using a CAD software CATIA which will

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allow us to design and simulate the bot. After the modelling and simulation part, the control part should be very efficient and reliable. The control part includes image processing which is achieved with the help of the digital camera which will detect the crop on the basis of colour. We are incorporating Arduino microcontroller which serves dual purpose i.e. for the movement of bot in the field and for obtaining data from sensors which are actuated by servomechanism. The wireless control of the agrobot will be achieved by the RF communication using the xbee modules which works on ZigBee protocol.

A. Designingand Simulation

This part plays one of the main role in project.We are using the CATIA software for doing accomplishing this part.All the parameters including the length,breadth,height,weight are measured and according to which motor torque is determined. The center of gravity (cg) is properly maintained.

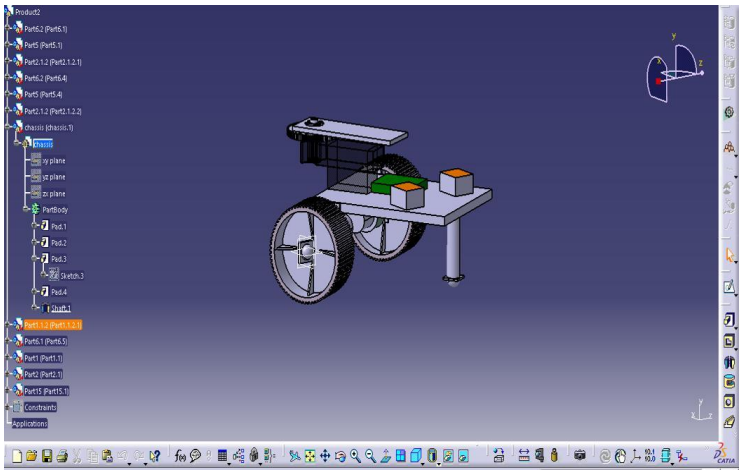

Fig.2 Designing in CATIA

B. Coding and Controlling

All coding related to drive the bot is done in Arduino IDE.Proper codes are written which will give command to the motor drivers.Codes related for sensing andtransmitting of data and controlling both dc and servo motors will also be uploaded to the Arduino.

C. Image Processing

In image processing,we are giving the stress on the color of the crops,for which we are incorporating the OpenCV and visual studios.OpenCV (Open Source Computer Vision) is a library of programming functions mainly aimed at real-time computer vision.Microsoft Visual Studio is an integrated development environment (IDE) from Microsoft. It is used to develop computer programs for MicrosoftWindows, as well as web sites, web apps, web services and mobile apps.We are using functions like contours and inrange which help to detect the boundary a well as color of the object which is in our case is the leaf of the crop.

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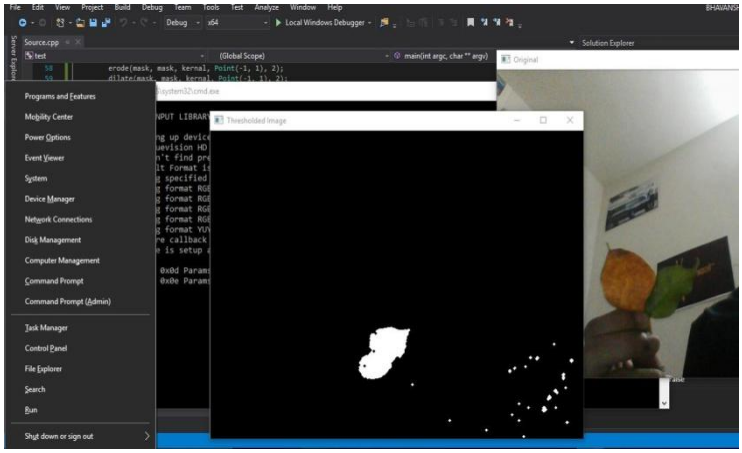

Fig.3 Real time Image Processing

V. FUTURE CONSIDERATIONS

In future we can implement Artificial Intelligence in the bot which will even further reduce the effort to feed the value for particular type of crops as AI is based on self learning process and ultimately make our bot fully autonomous.

VI. CONCLUSION

Our objective to automate the agricultural field was successfully achieved and hence in future if this technology is provided to farmers then it will surely increase the productivity of farmers and empower them financially and economically. This will also escalate export in agricultural field and will strengthen the economy of the country.

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