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Editorial

Since medicinal plants have a variety of uses in medicine, India has a great market for these plants in pharmaceutical, cosmetics and medicine. But sometimes these plants undergo substitution or adulteration because of unavailability of the plant. Hence it is important to correctly authenticate the plants. Therefore, nowadays DNA barcode is being used for proper identification and authentication of medicinal plants. Using DNA barcoding it is possible to identify the plants, their substitution and their adulterants at genus and species level.

A programmable logic controller, is a digital computer used for automation of typically industrial process. We know earlier computers required specialist programmers and stringent operating environmental control for temperature, cleanliness and power quality. Now an industrial control computer would have several attributes like it would have tolerate the shop-floor environment, it would support discrete input and easily extensible output, it would not require years of training to use and the response time. The first PLC designated 084 because it was Bedford Associates eighty fourth project. They have started a new company dedicated to developing, manufacturing, selling and servicing this new product MODICON, which stood for MOdular DIgital CONtroller. Mr. Dick Morley, who is considered to be the '*father*' of the PLC.

We invite you to read this month's articles and contribute to these discussions. Also, check us out on Facebook and leave us your opinions.

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NEWS AND VIEWS:-

REVIEW ARTICLE:-

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Manuscripts submitted to Quest should adhere to below mentioned criteria.
Research News: About 400 words (1 page)
Research Article: About 2000 words (4 pages)

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Line Spacing: 1
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References: 1) In text citing, S No, Superscript.
2) Author's name (s), *Journal name*, **Volume No**, Page No**,** (year).
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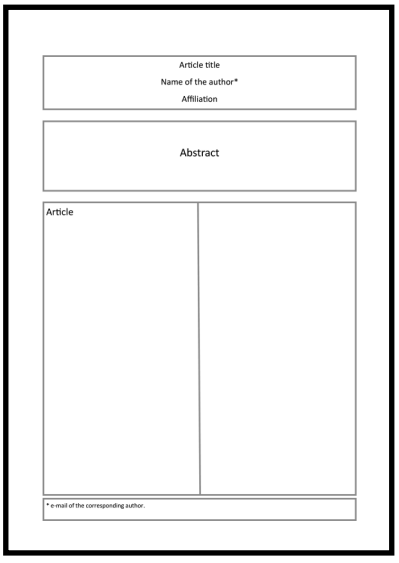

Eye tracking is the next frontier of human-computer interaction

Eye tracking devices sound a lot more like expensive pieces of scientific research equipment than joysticks – yet if the latest announcements about the latest Assassin's Creed game are anything to go by, eye tracking will become a commonplace feature of how we interact with computers, and particularly eye trackers provide computers with a user's gaze position in real time by tracking the position of their pupils. The trackers can either be worn directly on the user's face, like glasses, or placed in front of them, such as beneath a computer monitor for example.

Eye trackers are usually composed of cameras and infrared lights to illuminate the eyes. Although it's invisible to the human eye, the cameras can use infrared light to generate a grayscale image in which the pupil is easily recognizable. From the position of the pupil in the image, the eye tracker's software can work out where the user's gaze is directed whether that's on a computer screen or looking out into the world. But what's the use? Well, our eyes can reveal a lot about a person's intentions, thoughts and actions, as they are good indicators of what we're interested in. In our interactions with others we often subconsciously pick up on cues that the eyes give away. So it's possible to gather this unconscious information and use it in order to get a better understanding of what the user is thinking, their interests
and habits, or to enhance the interaction between them and the computer they are using.

Practical uses outside the lab

There are lots of useful applications. For example, in marketing and usability studies, eye trackers are commonly used to study the impact of an advertising campaign or the design of a website. For people who cannot use their arms or are completely paralyzed, eye tracking can be used to operate a computer or speech synthesizer: eye-based applications allow them to move a mouse cursor and spell out sentences using only their eyes.

Other more futuristic-sounding applications have been explored, such as appliances that listen to your commands when you look at them: imagine speaking "on" and "off" commands to your lamp, your hi-fi system or your television, which until you looked at them, had been in standby. Other examples include automatic scrolling when you have reached the bottom of a screen of text, or automatic pausing of a movie if you look away.

While there are uses for eye tracking in industry and among researchers, firms are now looking seriously at how to make them useful for the general public. Tobii – the same firm that brought us pizza ordering by mind control – recently launched a consumer-priced remote eye tracker, the Tobii EyeX (US$139) with the aim of encouraging games developers to build eye tracking support into their products. For comparison, research lab-grade eye trackers cost Another large eye tracking company, SMI, has announced a partnership with Sony to integrate eye-tracking into games for the PlayStation 4.

Interactivity at the cutting edge

There's a lot of potential for eye tracking in video games. For example, in the popular first-person view ("3D shooter") style of games, eye tracking can be used to automatically pan the screen to where the player is looking, replacing a task usually performed by the

mouse. The eyes can be used to target weapons, too.

One of the most interesting applications is interaction with game characters. When using eye tracking video game characters can be made to react to the player's gaze the same way a human would. Imagine entering a shop and letting your eyes rest on a sword you find interesting: the merchant could tell you directly about this item, making the interaction that bit more real. Or a character might get upset if, instead of looking at him while he's talking, your eyes rest on his wife. The eyes are very powerful means of nonverbal communication. Implementing human-like reactions in virtual characters could mean a whole new level of immersion in video games.

Beyond games, there is another range of applications where eye tracking is becoming a hot topic: smart glasses. Because of its shape, a lot of people think Google Glass also tracks the eyes, but it doesn't. But it wouldn't be surprising to see the next generation of smart glasses including eye tracking capabilities. This could provide further ways of interacting with the head-up display projected onto the glasses, adding automatic scrolling and navigation that leaves the wearer's hands free instead of having to use the manual control.

There's already an eye tracking upgrade for the Oculus Rift virtual reality headset. If users are willing to wear something on their heads, why not add an eye tracker too and enhance interaction using all that information that's being given away by the eyes? Using the eyes as a tool opens up the possibility for more natural, subtle interaction

-Contributed by Krishna Saraiya, M.Sc IGBT Sem-II

Tissue engineering: Scientists grow leg muscle from cells in a dish

A team of researchers from Italy, Israel and the United Kingdom has succeeded in generating mature, functional skeletal muscles in mice using a new approach for tissue engineering. The scientists grew a leg muscle starting from engineered cells cultured in a dish to produce a graft. The subsequent graft was implanted close to a normal, contracting skeletal muscle where the new muscle was nurtured and grown. In time, the method could allow for patient-specific treatments for a large number of muscle disorders. The results are published in EMBO *Molecular Medicine*.

The scientists used muscle precursor cells -- mesoangioblasts -- grown in the presence of a hydrogel (support matrix) in a tissue culture dish. The cells were growth factor that attracts other essential cells that give rise to the blood vessels and nerves of the host, contributing to the survival and maturation of newly formed muscle fibers. After the graft was implanted onto the surface of the skeletal muscle underneath the skin of the mouse, mature muscle fibers formed a complete and functional muscle within several weeks. Replacing a damaged muscle with the graft also resulted in a functional artificial muscle very similar to a normal *Tibialis anterior*.

Tissue engineering of skeletal muscle is a significant challenge but has considerable potential for the treatment of the various types of irreversible damage to muscle that occur in diseases like Duchene muscular dystrophy. So far, attempts to re-create a functional muscle either outside or directly inside the body have been unsuccessful. *In vitro*-generated artificial muscles normally do not survive the transfer *in vivo* because the host does not create the necessary nerves and blood vessels that would support the muscle's considerable requirements for oxygen.

"The morphology and the structural organization of the artificial organ are extremely similar to if not indistinguishable from a natural skeletal muscle," says Cesare Gargioli of the University of Rome, one of the lead authors of the study.

In future, irreversibly damaged muscles could be restored by implanting the patient's own cells within the hydro gel matrix on top of a residual muscle, adjacent to the damaged area. "While we are encouraged by the success of our work in growing a complete intact and functional mouse leg muscle we emphasize that a mouse muscle is very small and scaling up the process for patients may require significant additional work," comments EMBO Member Giulio Cossu, one of the authors of the study. The next step in the work will be to use larger animal models to test the efficacy of this approach before starting clinical studies.

Story Source

The above story is based on materials provided by EMBO - excellence in life sciences.

Journal Reference

Claudia Fuoco, Roberto Rizzi, Antonella Biondo, Emanuela Longa, Anna Mascaro, Keren Shapira-Schweitzer, Olga Kossovar, Sara Benedetti, Maria L Salvatori, Sabrina Santoleri, Stefano Testa, Sergio Bernardini, Roberto Bottinelli, Claudia Bearzi, Stefano M Cannata, Dror Seliktar, Giulio Cossu and Cesare Gargioli. *EMBO Molecular Medicine*, (2015)

-Contributed by Krishna Saraiya, M.Sc IGBT Sem-II

PLC based system for effective water distribution from Canals.

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Abstract: For the crop development water is very essential parameter. Water scarcity is becoming severe problem now days. It is difficult situation without water in agriculture. We propose Programmable Logic Controller (PLC) as an intelligent system which controls all actuating devices. All fields can be irrigated in a controlled manner through water from canals using PLC. Sensors detect the required water level in the canal and accordingly send the signals to the PLC. PLC Siemens S7-226 acts upon the response from the sensors and actuates gate for opening or closing. The water from the main canal to the secondary canal network can also be operated using the system. It can save the energy of human. Besides that, the volumes of water that irrigate the field can accurately follow the specifications. In canal automation, a gate or pump changes its position/setting in response to a water level. This type of controlled technology could improve irrigation efficiency and promote water conservation.

INTRODUCTION

The water availability is very critical variable virtually for every economic activity, including agriculture, industry, power sector and public use[1]. Moving towards new millennium, there are growing concerns and periodic warnings about an era of water scarcity. With increasing demand for food and competing use within the water sector, the pressure is on irrigation professionals to manage water efficiently[2]. One of the measures that have been considered is the introduction of some level of automation in the canal operation. Many types of irrigation controllers have been developed for controlling application ofwater[3-5]. The present paper gives an idea about gate controlled canal system for efficient distribution of water in the fields. The system provides flexible, accurate and reliable control of water supply through canal for irrigation purpose.

GENERAL SCENARIO

There are 202 dams in Gujarat out of them 95 dams have gates. Approximately these dams covers 1,70,000 sq.km catchment area for collecting water. There is also 2067.68 km long and complex canal network through which about 10 lakh hectares land gets water for irrigation and drinking purpose[6].

The farmers are dependent on seasonal rain and thereafter bore well water for their crops. This can be overcome by proper system which can control the whole network based on water level, flow and pressure control as per the requirement. Such things can be realize by automatic controlling system like PLC.

WHY TO USE PLC?

Water level in canal needs to be maintained effectively which is performed manually; requiring large staff and full time supervisor. This makes it very costly and inaccurate. Because of several features of PLC namely versatility, flexibility, digital nature and self diagnostic capabilities, expandability, easy programming, implementing changes and corre-

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citing errors and pilot running has been selected to automate the canal system in the present idea.

SYSTEM OPERATION

Figure 1. is the block diagram of canal network with gates and sensors at certain points. The canal system is having series of gates (G1 to G7). The dam water reservoir is having Master gate as G1. We have considered two fields which require water from the canal to model this system. Gates are placed at each inlet to the fields to check and control the excess of water in the fields. It also avoids backflow pressure on gates. Between every gate water level sensor is placed which continuously monitors the level of water and maintain the certain volume. Between G1 & G2 sensor S1 is placed, to control the level. This sensor signals PLC as soon as level reduces from the certain volume to open the gate G1. Sensor S2 is placed after gate G2 which is responsible for opening & closing the gate G2 as demanded by G3 or G5. Gate G4 is the inlet to field 1. As and when required by farmer he has to intimate the control system to supply water. After checking the status of water S3 triggers system to open G3. Same functioning can be carried out for the field 2 with control on G7 and G6 with the feedback from S5. Such inputs can be expanded as per requirements to include new fields. Hence sensors acts as input to the PLC and motor controls the gate actuation as an output action.

Depending on requirement we have selected a standard Siemens S7-200 series PLC with 24 digital inputs & 16 digital outputs of 24Vdc supply. In this system we have considered two farmers & five sensors as inputs & seven gates as outputs. The requirement is sufficed by S7-

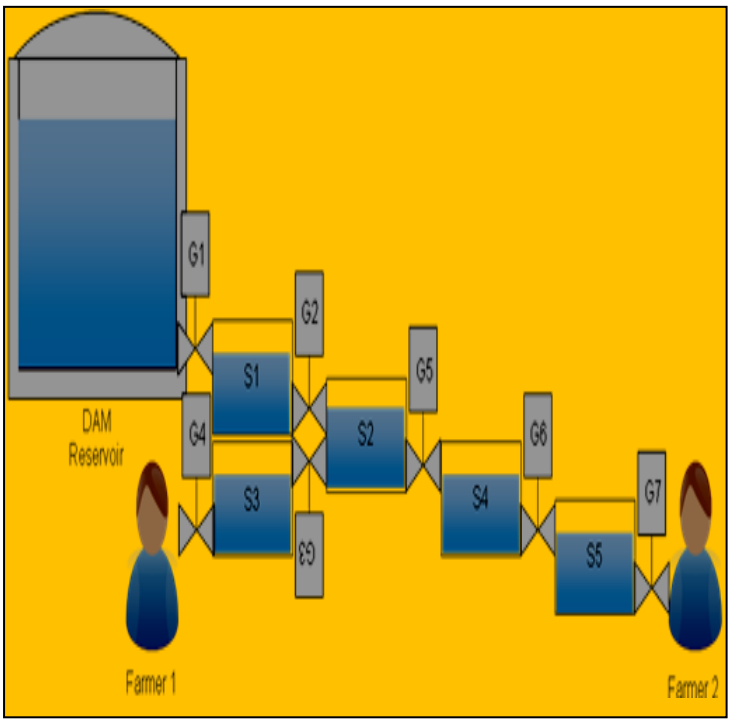

Figure 1. Block diagram for Gate control

226 CPU. The remaining inputs & outputs can be used for expansion. The terminal connectivity of gates and sensors with the PLC is shown in figure 2.

The sequential flow of gate control is shown through flow chart named as figure 3.

CONCLUSIONS

The system discussed here is based on Programmable Logic Controller having powerful capabilities to tackle number of input and output devices. Here it is used in monitoring water levels into the canal and accordingly control water distribution process in the fields.

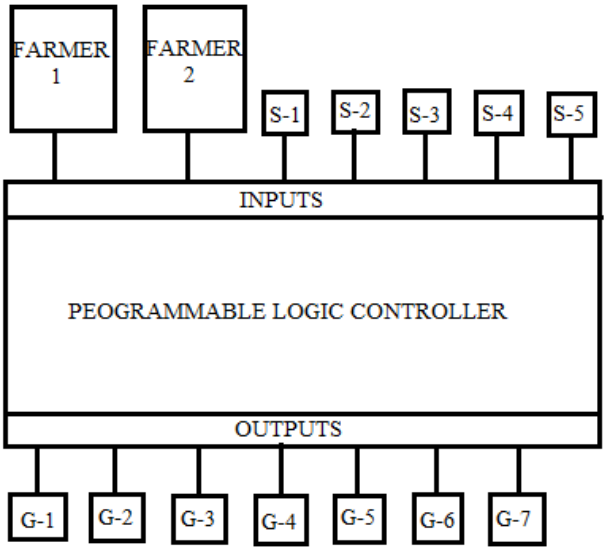

Figure 2. PLC connection diagram

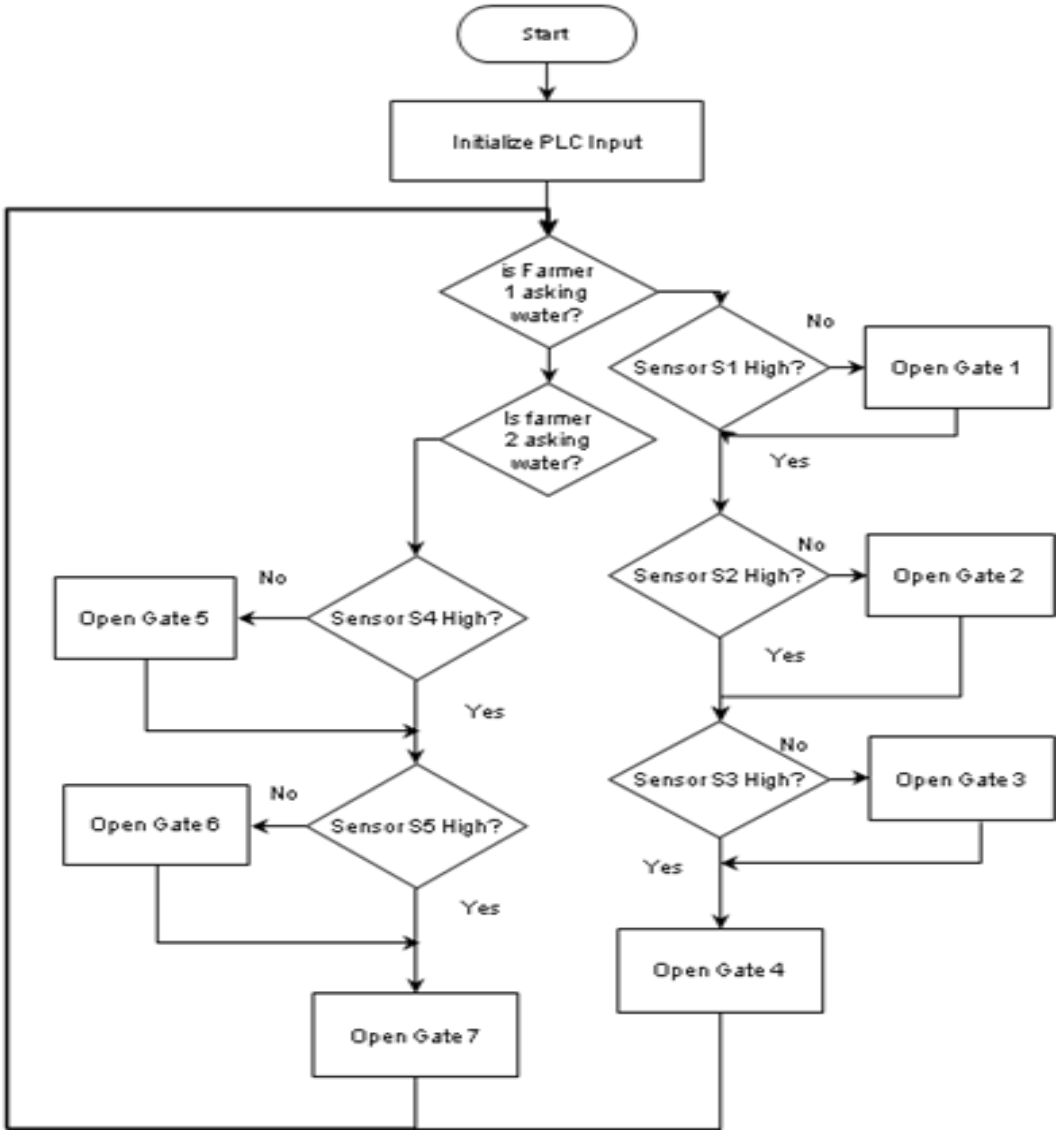

Figure 3. Flow-chart of the control strategy

This helps to suffice irrigation requirements for all farms as it is expandable system. It reduces manual work and improves efficiency for water distribution.

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DNA Barcoding: An identification of Medicinal plants, Databases and a Promising Future

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Abstract The demand of herbal medicines is rising day by day. It is going to be necessary to construct database for authentic identification of plants and their possible adulterants. Database can be coupled with DNA barcode for similarity search. There are several molecular methods which have been implicated to develop markers that lead to authentication and identification of medicinal plants. In this review we are going to discuss different genomic regions and molecular technique that provide barcode, available databases and the efficient future of DNA bar-coding.

Introduction

Traditional herbal medicines are raising popularity worldwide, about 80% of the world's population utilizes traditional medicines for well-being and healthcare.The traditional system of medicine implements medicinal plants to cure various diseases, however herbal industry undergoes from substitution and adulteration of medicinal herbs with closely related species. The reason might be miss identification or scarcity of correct herb. The adulterated drug in some cases mortal if substituted with toxic adulterants. Hence the correct formulation is important for the herbal drug to be effective. Based on investigations on adulteration of herbal medicines or misidentification of plants have health ramifications and due to carelessness it become life threatening.The world market of herbal medicines like herbal products and raw materials has been evaluated to have an annual growth rate between 5% to 15% and the universal herbal market is evaluated as US $62 billion and is habituated to grow to US $5 trillion by the year 2050[1]. There is a great treasure of traditional knowledge in India. Total 355 crores (US $813 million) are invested in international market per annum for Ayurvedic preparations. The demand of medicinal plant related trade in India is predicted at Rs. 5000 crores per annum.There is great opportunity sector for Indian trade and commerce in the field of pharmaceuticals, nutraceutical, cosmetics and other products due to the increased demand of medicinal plants.

Identification of dried medicinal plant abides of traditional organoleptic methods includes identification by various senses like taste, sight, smell and touch. The latest technology covers macroscopic and microscopic methods based identification by shape, colour, texture and chemical profiling with modern techniques of HPTLC, HPLC, UV, GC, IR, MS, NMR. Nonetheless of these methods

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can identify the related species easily in processed products because these methods require expertise and even to find unique characters to set keys for identification is difficult for macroscopic and microscopic features. In the latter methods, chemical profiles or markers may be varied based on geographic, seasonal, physiological or storage conditions. Authentication at DNA level provides more accuracy since it will not affected by external factors and is found same in all tissues. Therefore development of DNA-based markers is important for authentication of medicinal plants.

The recent technique used for the identification of biological specimens samples uses short DNA sequences from either nuclear or organelle genome is called DNA Barcoding. The term 'DNA barcode' was first suggested by Paul Hebert of University of Guelph in 2003[2] .To afford fast and correct identification of unidentified organisms whose DNA barcodes have already been archived in a sequence library such like Barcode of Life Database (BOLD, www.barcodeoflife.org) is the main desire of DNA barcoding[3]. Plants and animals both are having various scientific applications of DNA barcoding in ecology and evolution.There are varieties of loci available as DNA barcodes for plants, containing coding genes and non-coding spacers in the nuclear and plastid genomes. The selection of a barcode locus is complicated by the trade-off that arises between the need for universal application and maximal rates of sequence divergence[3].

Loci applicable for plant barcode

There are several chloroplast loci which have been utilized as plant barcodes. Out of that four are portions of coding genes (*matK, rbcL, rpoB, and rpoC1*), and three are non-coding spacers (*atpF–atpH, trnH–psbA*, and *psbK–psbI*). Many research groups utilized ndhJ, *accD*, *YCF5* of chloroplast genome and internal transcribed spacer regions of nuclear ribosomal DNA (rDNA ITS) for DNA barcoding.

The graphical map of chloroplast genome is drawn (Figure 1) through the online available "OrganellarGenomeDRAW" free web tool (http://ogdraw.mpimp-golm.mpg.de) developed by Marc et al. (2013). The whole genome sequence of tomato chloroplast[4]. is downloaded in GeneBank format having gb. extension from NCBI database and uploaded in above tool to construct physical map.

Rather than DNA barcoding there are also other PCR- Based methods which have been applied to develop markers that help in authentication and identification of medicinal plants. These methods are RAPD, RFLP, microsatellites, ISSRs, SNPs and ARMS[5]. RAPD and SCAR markers have been refined for the identification of several medicinal plants[6].

Internal transcribed spacer (ITS2) of nuclear ribosomal DNA is applied for fungal identification. However the same locus suggested for medicinal plants by Chen et.al. (2010). They did comparison among seven candidate barcodes (*psbA-trnH, matK, rbcL, -rpoC1, ycf5*, ITS and ITS2) and recommended ITS2 as the most applicable regions for barcode applications. They attempted discrimination ability of ITS2 in more than 6600 plant samples belonging to 4800 species from 753 different genera.

Advancement in sequencing technology

Traditional DNA barcoding technique is powerful method for identification of me-

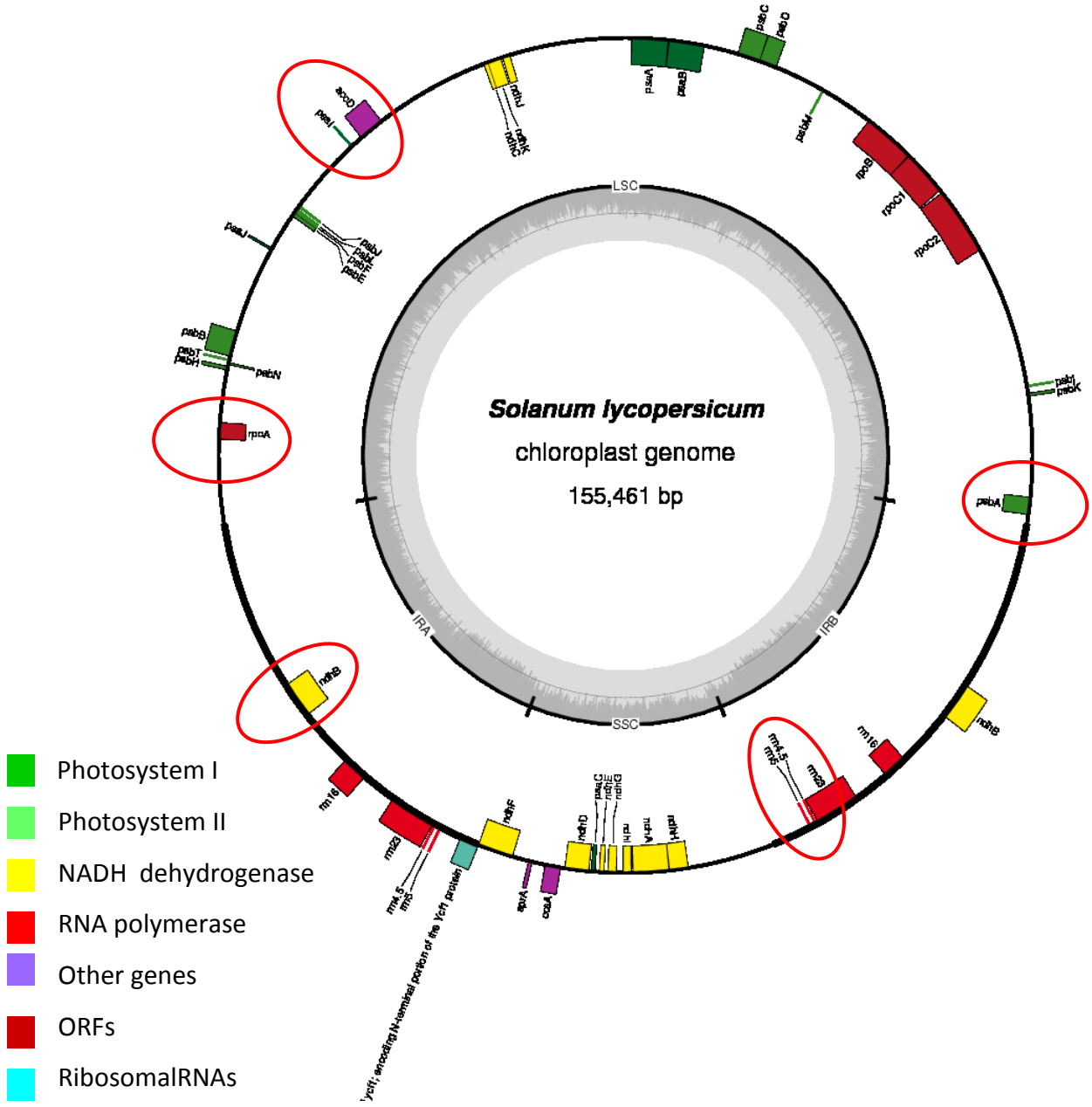

Figure 1. Annotations of chloroplast genome of Tomato (Solanum lycopersicum cultivar IPA-6, NCBI GeneBank acession number AC_000188.1) indicated possitin of DNA barcode specific

cinal plants, however the more advance and newly refined version is next generation sequencing (NGS)[18]. NGS is done with entire genomic DNA whereas barcoding is done with PCR followed by Sanger's method of sequencing. However NGS is too costly and not practical as PCR amplification, the availability of NGS instrument is also limited compare to PCR, NGS required time and skill, and even data analysis needs computational skills and advance IT infrastructure. Genome sequence is not available for all the species. In that case still barcode is more practical than NGS.

Requirements and method of analysis for barcoding

Molecular methods required intact DNA, it will be challenging to isolate from processed

Table 1.The list of barcode-regions applied for identification.

Name of plant and family	Barcode candidate gene
Sideritis trojana (Lamiaceae)	*matK*[7]
Pueraria candollei, Butea superba & Mucunacollettii (Leguminosa)	*matK*[8]
Rheum rhabarbarum, (Polygonaceae)	*matK*[9]
*Hypericum perforatum (*Hyperiaceae*)*	ITS[10]
*Dendrobium tosaense (*Orchidaceae)	ITS[11]
*Ophiopogon japonicas (*Liliaceae*)*	ITS[12]
*Paris polyphylla(*Melanthiaceae)	ITS[13]
Radix Astragali(Fabaceae)	ITS[14]
*Dendrobium species(*Orchidaceae)	ITS[15]
Senna species(Fabaceae)	*psbA-trnH*[16]
Paris polyphylla(Melanthiaceae)	*psbA-trnH*[17]

plant products because the DNA is often highly degraded or material contains high amount of polysaccharides, polyphenols and other secondary metabolites such as phenols, alkaloides and flavanoides which degrades DNA.

Search engine and sequence repositories

BOLD (The Barcode of Life Database)

BOLD was created and is maintained by University of Guelph in Ontario[19]. It contains single barcode library for all living species including plant, animal and fungus. It gives information to the researchers about how to collect, manage, and analyze DNA barcode data. The main purpose of BOLD is to provide a barcode library for all eukaryotic life over the next 20 years.

iBOL(International barcode of life project)

A group of hundreds of scientists of 25 different countries working together through iBOL (www.ibol.org) to build a authentic DNA barcode reference library. The target of iBOL is to cover five million specimens representing 50000 species up to (2010-2015).

CBOL (Consortium for the barcode of life)

CBOL (www.barcodeoflife.org) was established in the year 2004. CBOL contains 200 member organizations from 50 different countries and pirates from Secretariat Office located in the Smithsonian Institution's National Museum of Natural History in Washington, DC[20]. It broadcasts barcodes through workshops, networks, working groups, conferences, outreach, and training. It is a public reference library for species identifiers which is used for the identification of unknown specimens with reference to DNA barcode of known species which is already submitted.

The Genebank

The Genebank is online genetic sequence database[21]; www.ncbi.nlm.nih.gov/genbank). It is one of the most frequently used databases for genomic authentication[22]. Genebank is an important storage place of genetic information. There are total 108 million entries for over 260000 named organisms. In Genebank

an unknown DNA sequence can be compared to identify the sample with the help of BLAST[23].

MMDBD (Medicinal Materials DNA Barcode Database)

MMDB (http://137.189.42.34/mherbsdb/index.php) is a website that contains DNA sequences and their information and important references of medicinal records of the pharmacopeia of the People's Republic of China, American Herbal Pharmacopoeia and other related references. The database was last updated in May 2012 with 1658 species and 31,468 sequences. MMDBD database gives information on distinguishing medicinal materials (plant, animal, and fungi) from their common substitutes and adulterants[24.]

The GDR (Genome Database for Rosaceae)

The GDR was Created in the year 2009. It contains information regarding genetic markers and available ESTs of Rosaceae family (www. rosaceae.org).

Conclusion

DNA barcoding is an accurate tool for identification of medicinal plants their substitutes and their adulterants at genus as well as species level. Based on literature evaluated in this review choices of *rbcL* and *matK* is suitable for medicinal plant identification. Depending on the type of material analyzed combination up to three genomic regions was important to provide sufficient information for identification.

Because of raising demand of herbal remedies, authentication of plant material is important hence it is necessary to provide an exclusive database containing DNA sequences for easy identification. Future advances of sequencing to evaluate large scale nucleic acid sequences provide an advantage of genotyping of taxon, which will provide tool to identify species from even damaged and fragmented DNA template.

Acknowledgements

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