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पेटेंट कार्यालय का एक प्रकाशन
PUBLICATION OF THE PATENT OFFICE

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(57) Abstract :

IoT and AI based Automatic leaf disease detection System in different crop species through image features analysis and one class classifiers using Deep Learning Algorithms Abstract: Agriculture contributes approximately 15% of the total GDP. Continued obstacles to agricultural productivity and the spread of disease lead to substantial economic losses for countries. Hence, early detection of diseases can help reduce the severity of their effects and protect crops from being harmed. The manual diagnosis of diseases is labor-intensive, fraught with the possibility of making mistakes due to human error, and calls for an expert level of knowledge of plant pathogens. Automation, on the other hand, cuts down on both the amount of time and labour needed. In this paper, we give an up-to-date review of the research that has been conducted over the past decade to diagnose illnesses in various crops using machine learning, deep learning, image processing techniques, the Internet of Things, and hyperspectral image analysis. The research has been carried out in order to improve the accuracy with which diseases can be identified and treated. In addition, a variety of different diagnostic approaches for agricultural diseases were compared and contrasted in terms of both their similarities and their differences. This study also investigates the multiple challenges that need to be conquered as well as possible solutions to these challenges. In the following paragraphs, several potential resolutions to these issues will be discussed. In conclusion, the findings of this study give an overview that has the potential to develop into an extremely helpful and significant resource for academics engaged in the detection of crop diseases.

No. of Pages : 12 No. of Claims : 8

FORM 2

THE PATENTS ACT 1970

39 OF 1970

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THE PATENT RULES 2003

COMPLETE SPECIFICATION

(SEE SECTIONS 10 & RULE 13)

1. TITLE OF THE INVENTION

IoT and AI based Automatic leaf disease detection System in different crop species through image features analysis and one class classifiers using Deep Learning Algorithms

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2. PREAMBLE TO THE DESCRIPTION

COMPLETE SPECIFICATION

The following specification particularly describes the invention and the manner in which it is to be performed

IoT and AI based Automatic leaf disease detection System in different crop species through image features analysis and one class classifiers using Deep Learning Algorithms

Abstract:

Agriculture contributes approximately 15% of the total GDP. Continued obstacles to agricultural productivity and the spread of disease lead to substantial economic losses for countries. Hence, early detection of diseases can help reduce the severity of their effects and protect crops from being harmed. The manual diagnosis of diseases is labor-intensive, fraught with the possibility of making mistakes due to human error, and calls for an expert level of knowledge of plant pathogens. Automation, on the other hand, cuts down on both the amount of time and labour needed. In this paper, we give an up-to-date review of the research that has been conducted over the past decade to diagnose illnesses in various crops using machine learning, deep learning, image processing techniques, the Internet of Things, and hyperspectral image analysis. The research has been carried out in order to improve the accuracy with which diseases can be identified and treated. In addition, a variety of different diagnostic approaches for agricultural diseases were compared and contrasted in terms of both their similarities and their differences. This study also investigates the multiple challenges that need to be conquered as well as possible solutions to these challenges. In the following paragraphs, several potential resolutions to these issues will be discussed. In conclusion, the findings of this study give an overview that has the potential to develop into an

extremely helpful and significant resource for academics engaged in the detection of crop diseases.

DESCRIPTIONS:

Agriculture serves as the primary source of income for a lot of countries around the world. There is no question that the demand for food is growing at the same rate as the global population. It is absolutely necessary to increase agricultural production while at the same time safeguarding crops in order to satisfy this pressing need. Plants, on the other hand, are particularly susceptible to a wide variety of diseases due to the exceptionally high concentration of pathogens that naturally occur in the environment in which they grow. Infectious agents that are responsible for disease may be in the form of viruses, fungus, or bacteria. When crop diseases diminish production by as much as 95%, there is a significant decrease in both the quantity and quality of the food that is produced. Hence, early disease diagnosis is vital in order to avert substantial losses and reduce the abuse of pesticides, both of which can be harmful to both human health and the environment. The vast majority of agricultural diseases may be identified by a farmer using nothing more than his or her eyes; this is especially true in countries with lower levels of development and on smaller farms with fewer resources. This method requires a significant amount of treatment time and in-depth familiarity with plant pathology, both of which are time-consuming and labor-intensive. In addition, if a farmer suspects that their property has been infected with a disease that is extremely uncommon, they will confer with medical experts to ensure a precise and

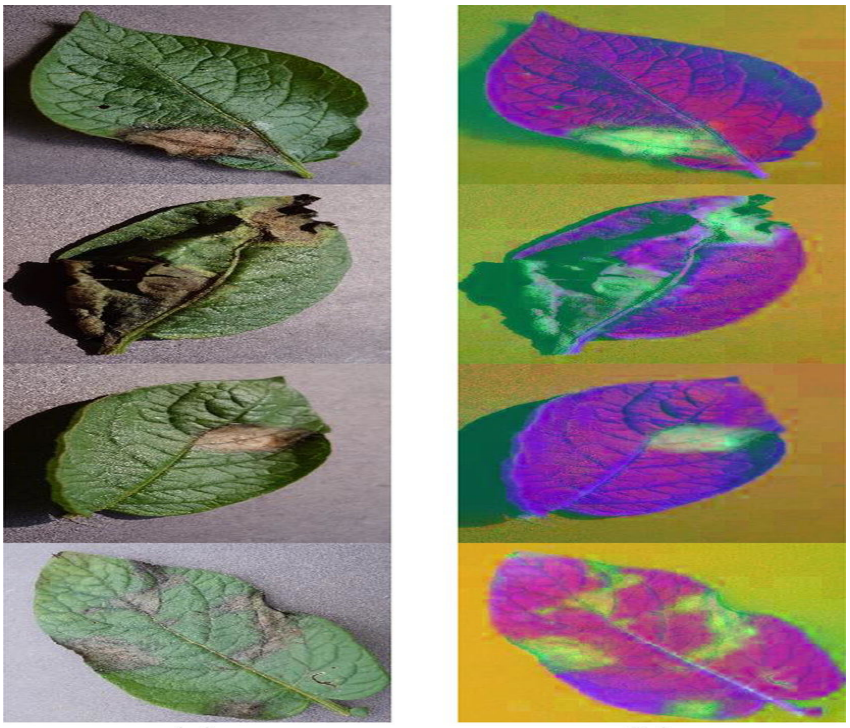
speedy diagnosis. As a consequence, it is unavoidable that the cost of healthcare will go up. Hence, implementing this method of eye observation on huge farms is not only infeasible and impractical, but it also bears the risk of delivering false forecasts due to biassed perceptions. This is because eye observation is susceptible to subjectivity. The development of methods that are quick, precise, and reliable for the early identification of agricultural diseases is something that scientists have been tasked with doing. This accomplishes two goals: meeting the increased demands of consumers and lowering the harmful effects that chemical inputs have on both the natural environment and human health. Since the conventional approach has a number of drawbacks, researchers have been searching for technological substitutes to serve as a source of ideas. Within this framework, a variety of potential solutions have been proposed as workable approaches to automating the identification of diseases. Both direct and indirect methods have been included in this collection of strategies for the automatic recognition of agricultural diseases. Both types of methods are represented in equal measure. Methods that are considered direct include tests of a molecular or serological nature, which can be used to identify infections that are the direct cause of disease. The direct methods offer the highest level of precision and directness in terms of detection, but they are time-consuming due to the extensive sample collecting, processing, and analysis that is necessary. Optical imaging techniques, on the other hand, are an example of indirect approaches that can be used to detect diseases and anticipate the crop's health by monitoring signals such as morphological change and transpiration rate. These techniques fall into the

category of indirect disease detection methods. These methods are more capable of prediction than they are of diagnosis. For the purpose of making an indirect diagnosis early on in the progression of an illness, fluorescence and hyperspectral imaging are frequently utilised. Despite the fact that hyperspectral photos are a substantial data source and include more information than regular photographs, hyperspectral sensors are excessively expensive, unwieldy, and difficult for farmers with modest incomes to acquire. [Citation needed] Conversely, discount electronic retailers typically carry a wide variety of digital cameras at costs that are more reasonable. Because of this, the vast bulk of research into automatic identification methods has focussed on visible-domain images. This is because algorithms can be exceedingly exact and speedy when applied to images in this domain. As a result, the primary emphasis of this research is placed on the numerous image processing and spectroscopy-based technologies that can be used to automate the identification of agricultural diseases. Deep learning, machine learning, fuzzy logic, and transfer learning are just a few examples of the methodologies and techniques that fall under this category. Modern agriculture is being challenged in significant ways by the spread of invasive plant diseases. It is possible to lessen the severity of crop diseases and prevent their spread across farms if they are identified and treated in the early stages of their development. In recent years, this has led to a large amount of ground-breaking research on a wide variety of approaches to disease diagnosis, some of which are displayed below for your perusal. The most striking differences between this study and others are the comprehensive technical analysis of each individual piece of

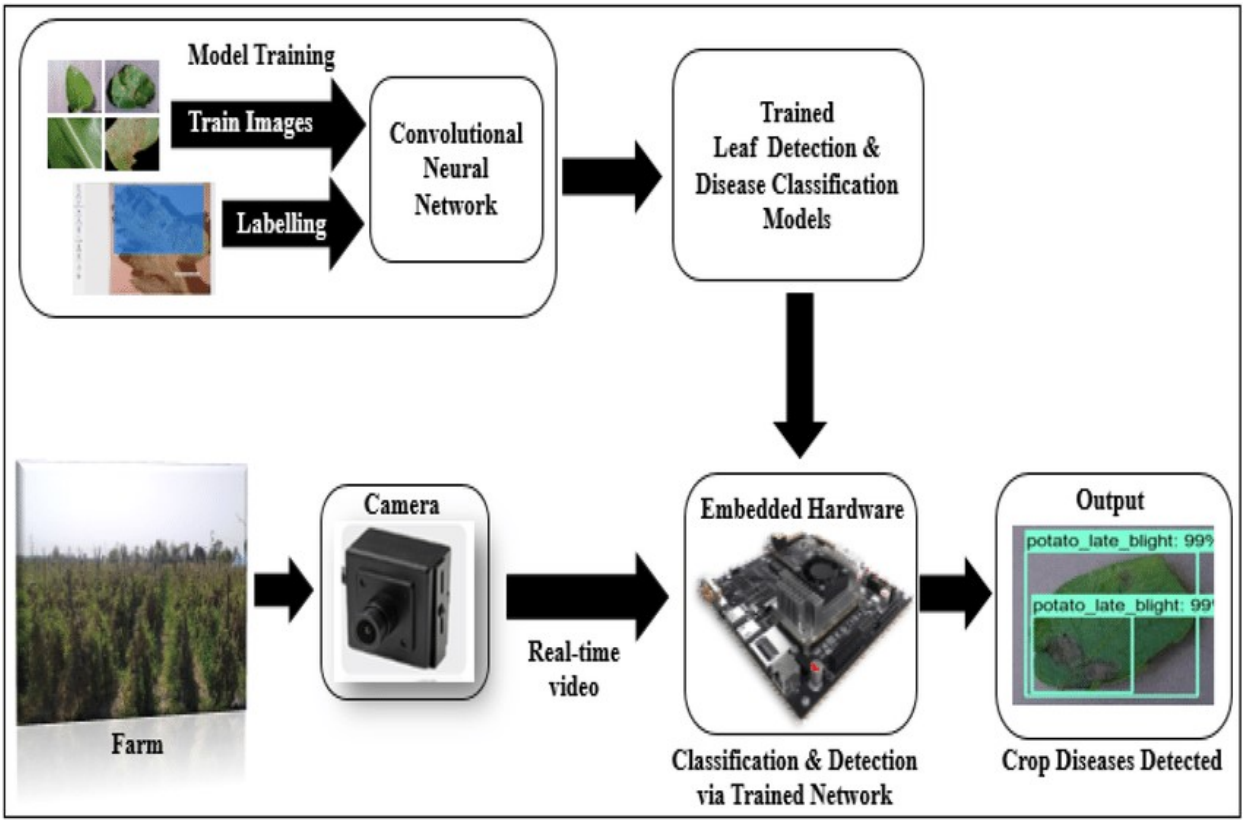
research and the application of a wide variety of methodologies. Both a guideline and a list of references are made available to the scientific communities as a result of this. The results of this study will also give readers with an understanding of the methodology and important considerations that go into the process of automatically identifying crop diseases. There is a lack of clearly defined borders surrounding symptoms, which is one important element. Other important characteristics include unstable imaging, changing sickness symptoms, comparable symptoms across disorders, and the co-occurrence of symptoms from multiple conditions. The efficiency of the currently available image processing technologies and analytical tools is significantly hindered as a direct result of these concerns. The findings of this survey indicate that the manner in which an image is prepared has a significant bearing on the segmentation technique used. In addition, it was discovered that the k-means clustering algorithm was the most efficient method for locating and separating leaves that were damaged in some way. Also, it was demonstrated that CNN-based models are superior when it comes to identifying visual patterns present in images. It is essential to bear in mind that the application of artificial intelligence and computer vision for the purpose of diagnosing agricultural problems is a relatively recent phenomenon in the field of agriculture. This suggests that a significant number of the opportunities and advantages presented by these technologies, which could contribute to the solution of the issues described earlier, have not yet been thoroughly investigated. Also, because there is now greater computer power available, procedures that were previously impossible to accomplish can be

easily applied. The researchers intend, as part of their future work, to design a system that is efficient, accurate, inexpensive, and quick in diagnosing crop diseases from foliar photographs as a result of their in-depth review of the existing literature on autonomous crop foliar disease detection. This was the result of their in-depth review of the existing crop foliar disease detection literature. This identification mechanism will also be put in a smartphone application that will alert the farmer as soon as the disease is found, allowing him to take steps to prevent the sickness from spreading further.

DRAWINGS:



(a) (b)



CLAIMS

1. IoT and AI based Automatic leaf disease detection System in different crop species through image features analysis and one class classifiers using Deep Learning Algorithms a cutting-edge science technology.

2. IoT and AI based Automatic leaf disease detection System in different crop species through image features analysis and one class classifiers using Deep Learning Algorithms of claim 1, wherein said that it can be used for a variety of purposes.

3. IoT and AI based Automatic leaf disease detection System in different crop species through image features analysis and one class classifiers using Deep Learning Algorithms of claim 1, wherein said the proposed system is more accurate and faster.

4. IoT and AI based Automatic leaf disease detection System in different crop species through image features analysis and one class classifiers using Deep Learning Algorithms of claim 1, wherein said that in this paper, we analyzed and discussed various aspects.

5. IoT and AI based Automatic leaf disease detection System in different crop species through image features analysis and one class classifiers using Deep Learning Algorithms of claim 1, wherein said that in recent years, leaf disease become a hot topic in medical sector.

6. IoT and AI based Automatic leaf disease detection System in different crop species through image features analysis and one class classifiers using Deep Learning Algorithms of claim 1, wherein said that it is a reliable and efficient system for monitoring variables.

7. IoT and AI based Automatic leaf disease detection System in different crop species through image features analysis and one class classifiers using Deep Learning Algorithms of claim 1, wherein said that this research looks at all of

the important and recent work that has been done so far, as well as its limitations and challenges.

8. IoT and AI based Automatic leaf disease detection System in different crop species through image features analysis and one class classifiers using Deep Learning Algorithms of claim 1, wherein said that Additional types may be studied in the future.