Automatic Tamoto Crop Disease Prediction System by Using the Deep Learning Approach

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Abstract
Agriculture is a major requirement for humans in all over the world. It plays a major role in the food commodities. Most of the famers face a lot of loss due to the agricultural crop diseases. Here particularly focused on the tomato crop diseases that may occur due to the climatic conditions are various other factors. Here the deep convolution neural network is used to detect the diseased crop with the dieses name by classifying the healthy and diseased tomato crop plants automatically from the data that collected from crops by using the Agri-electronic device. With this the diseases can be detected in early stage so that the yielding of the crops can be improved. The results have achieved the effective detection accuracy.
Keywords: Agriculture, tamoto crops, dieses prediction, deep learning, and convolution networks.

I. INTRODUCTION

The major source of income in India is the agriculture. As per the statistics the GDP [1] of agriculture alone is 22% and has allocate the budget for introducing the scientific methods in the development of the agriculture. Even though the famers are facing a lot of issues such as adequate distribution of the water, un even distribution of the water, damage of the crops by the insects and pesticides and the crop disease [2]. Lot of research has been done by the most of the researchers related to the agricultural fields to overcome the issues that occurred [3] [10-13]. The monitoring of the fruits not to cause damage is also a major issue [4], to do this the researchers proposed a model for early prediction of the diseases and applying the pesticides by spring to the crops. By using internet of things technology, the precision agriculture can be done to analyze, identify and manage the fields to get profits, sustainability and protection of the crops [5]. To protect the crops from the disease like black/brown lesions on the leaves for the various crops the technologies like internet of things and deep learning can be used. The precision agriculture has done here by using the machine learning technique

called artificial neural networks [6], with the combination of the internet of things technology for prediction of the data for the farmers. Here proposed a system for the prediction of tomato crops, the Various tomato crop diseases are listed in the figure 1.1. Here used a deep convolution neural network for early prediction of the tomato crop diseases by automatically detecting the diseases from the fields by using the Agri-device. The next sections discussed about the related work in section II, proposed system in the section III, implementation in section IV, results and discussion in section V and finally in section VI discussed about the conclusion and future work.

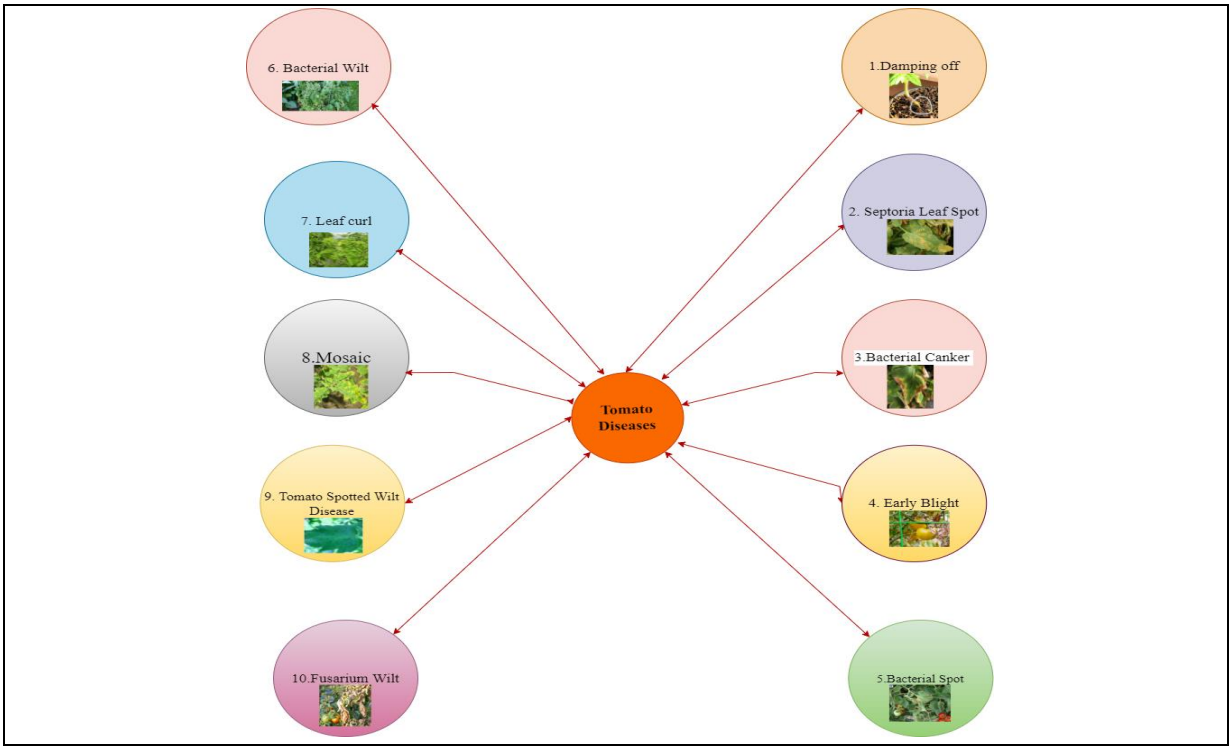

Figure 1.1: Tomato diseases

II. RELATED WORK

The identification and detection of the borer insects in tomato's has done by using the cloud computing technology [4] and called as a smart farming. The Artificial neural networks with the help of the internet of things, predicted the nature of the crops of the tomato and potato [5-8]. The robot is used to monitor the fields, by moving in and around the fields [8]. Here the remote collect the information from the sensors in the field and can monitor it remotely. With this the remote monitoring is possible. To detect the disease in the grape plant [9], support vector machines classification algorithm is used.

III. PROPOSED SYSTEM

Here the Agri electronic device is used to collect the data from the tomato crop. The data is the images of the crop along with the sensor values sensed from the sensors. The Agri electronic device is an IoT (Internet of Things) based device which will send the collected data to the cloud by using the internet technology. After the data is stored in the cloud to

analyze that data, the deep neural network algorithm is used. By using this algorithm, the crop diseases are predicted automatically and communicated to the farmers by the local alert and the global alert by using the buzzer sound locally and SMS globally to the mobile phones. The process is shown in the figure 3.1.

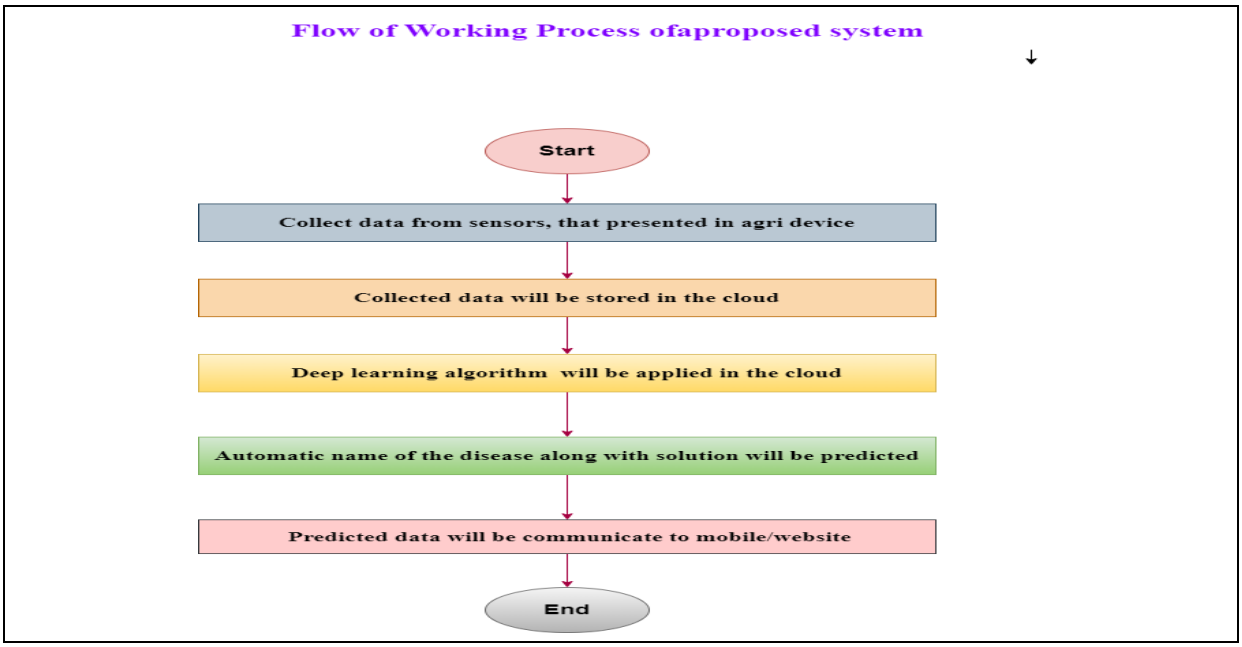

Figure 3.1: The working process of the proposed system

The proposed system is shown in the figure 3.2. the Agri electronic devices are placed in a crop in ordered to cover all the crop to collect the data to the cloud. In the cloud the algorithm will run continuously to predict the diseases based on the trained data and communicated to the user, so that the user will get alert and take the necessary actions to improvise the crop yield.

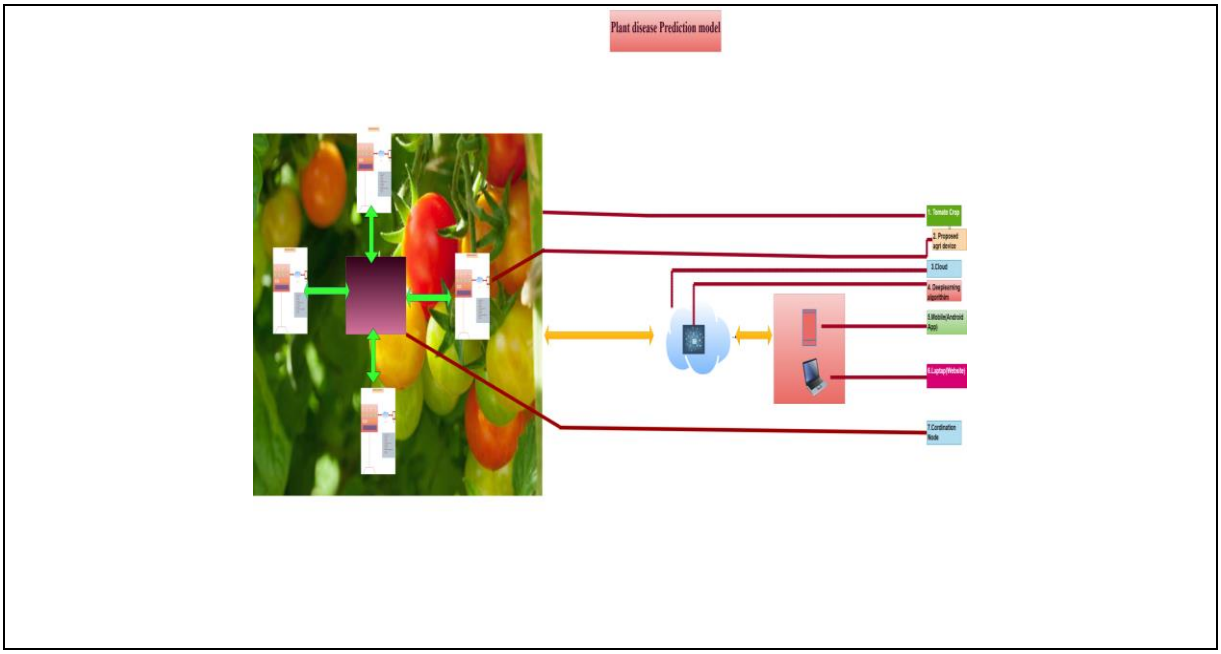

Figure 3.2: The proposed system

The Agri electronic device is shown in the figure 3.3. it consists of the sensors, microcontrollers and internet connectivity. The sensors are camera sensor, temperature sensor, humidity sensor, water level sensors and moisture sensors. The device will be placed in the whole crop to cover all the crops to collect the data continuously to the cloud with the internet connectivity. The Agri device has a connectivity technology like Bluetooth, LoRa and internet, based on the user can be used any connectivity device to push the data to the cloud. In the place of the cloud the data can be stored in the centralized server also based on the user choice. As the data is stored the analysis algorithm can be user choice. So, this device is user friendly and has various options and can be used in any kind of the crop. Here for the tomato crop is used to collect the data.

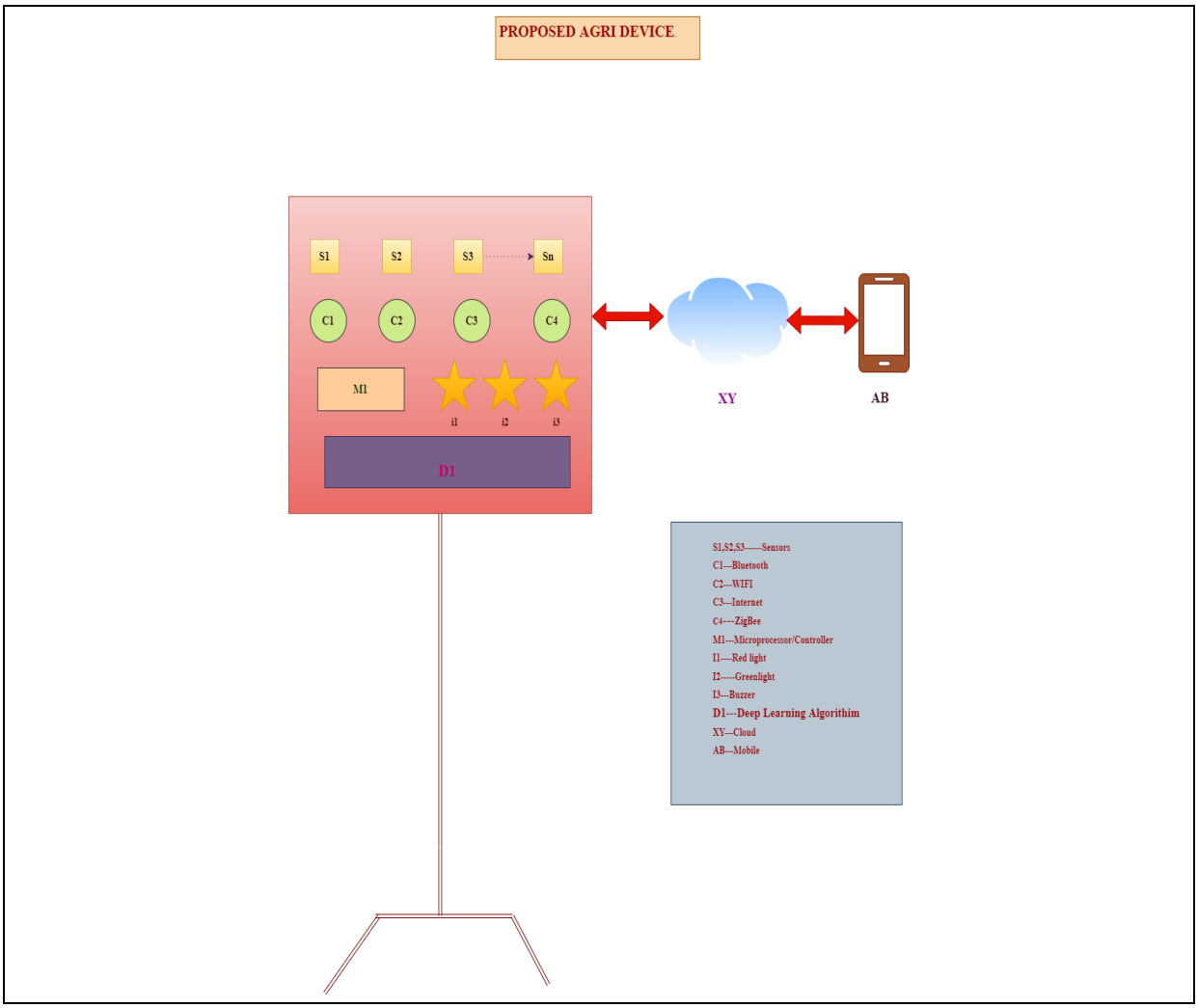

Figure 3.3: The Agri electronic device

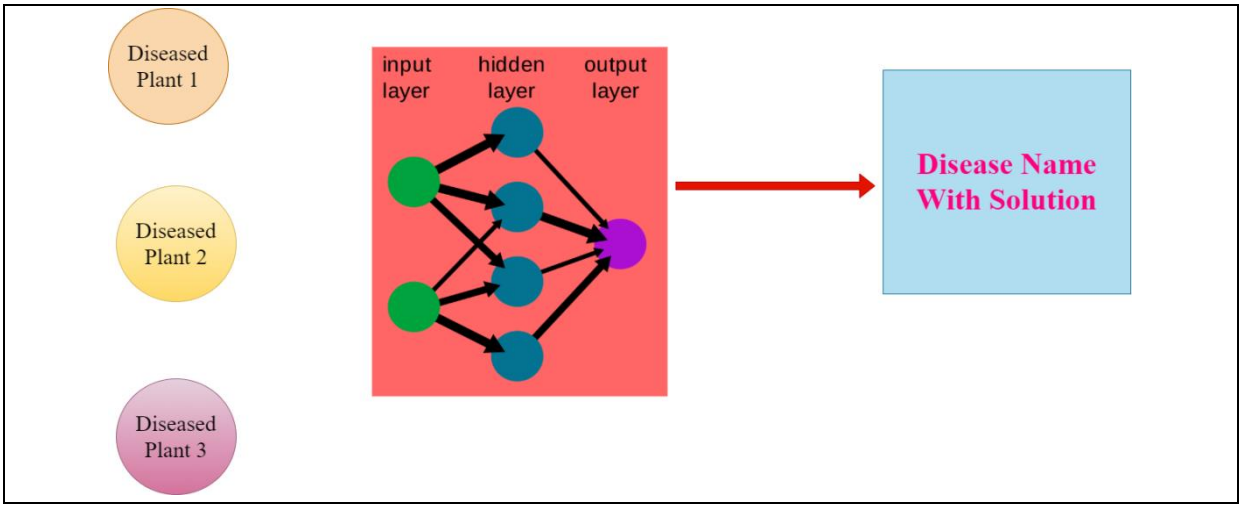

Figure 3.4: The working of the Deep learning algorithm

The figure 3.4 shows the working of the algorithm that used to analyze the collected data from the Agri device that placed in the tomato crops. The deep neural network algorithm has a layers like input layer, hidden layer and output layer. With this the model is developed to automatically classify the healthy plants and diseased plants. After classifying, based on the diseased plants the name of the disease and the remedy for that device also automatically identified and communicated to the user. Based on this the user will take appropriate action in the correct time, with this the crops growth and yield are improved.

IV. IMPLEMENTATION

The work is implemented in the tomato crop at Tirupati. The Agri device has put in the fields for 6 months and the data is continuously stored in the centralized server and in the things speak cloud platform. The data stored in the centralized server is preprocessed and then applied the deep convolution neural network algorithm. The obtained results are shown and discussed in the results and discussion section.

The data set consist of the collection of images of the tomato crops and the sensed values with the attributes image, water level, temperature, humidity and the moisture level. The images are separately analyzed and sensed values are separately analyzed and formed a model to predict the diseases names of the tomato crop along with the solution to overcome those diseases. In the python script along with the various modules in it is used to implement the proposed system.

V. RESULTS AND DISCUSSION

The obtained results after implementation are shown in the figure 5.1, 5.2, 5.3, and 5.4. the figure 5.1 shows the accuracy in terms of the time, the figure 5.2 shows the True positive rate with respect to the time, the 5.3 shows the False positive rate with respect to the time and the figure 5.4 shows the prediction rate with respect to the time. The units are the percentage and the seconds.

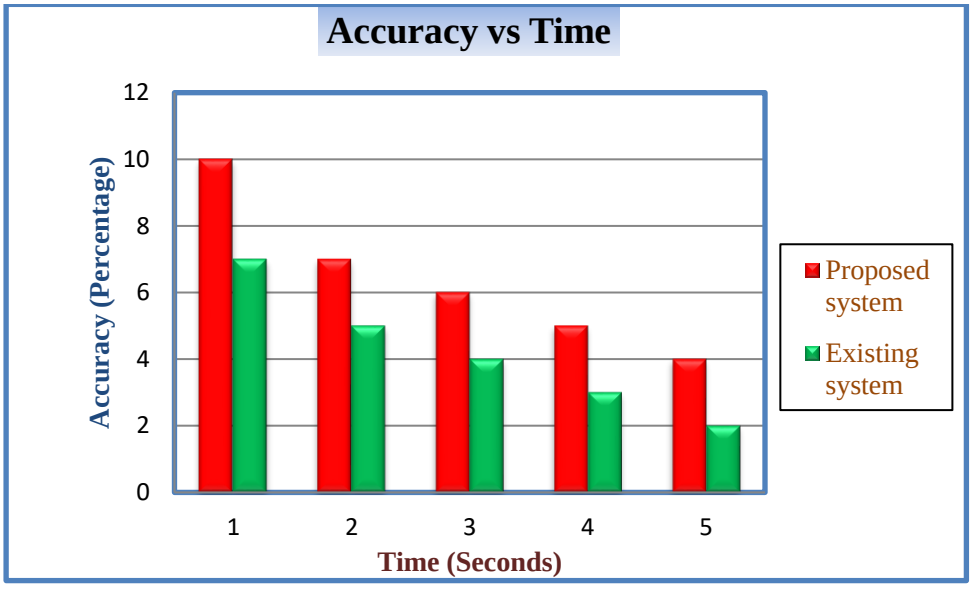

Figure 5.1: Accuracy with respect to the time

In the figure 5.1 when the proposed system is compared with the existing system the accuracy shows high. The accuracy for classifying the healthy and diseased crops is high. And the accuracy for the disease name with remedy also high. As the time increases the data is getting more and the accuracy is decreasing, but when compare with the existing system the proposed system shows good accuracy rate. In the figure 5.2 and 5.3 shows the True positive and False positive rates, while working with the model the true and false positive rates also analyzed and compared with the existing systems show the effective results. The disease prediction rate is show in the figure 5.4 and shows effective when compared with the existing systems.

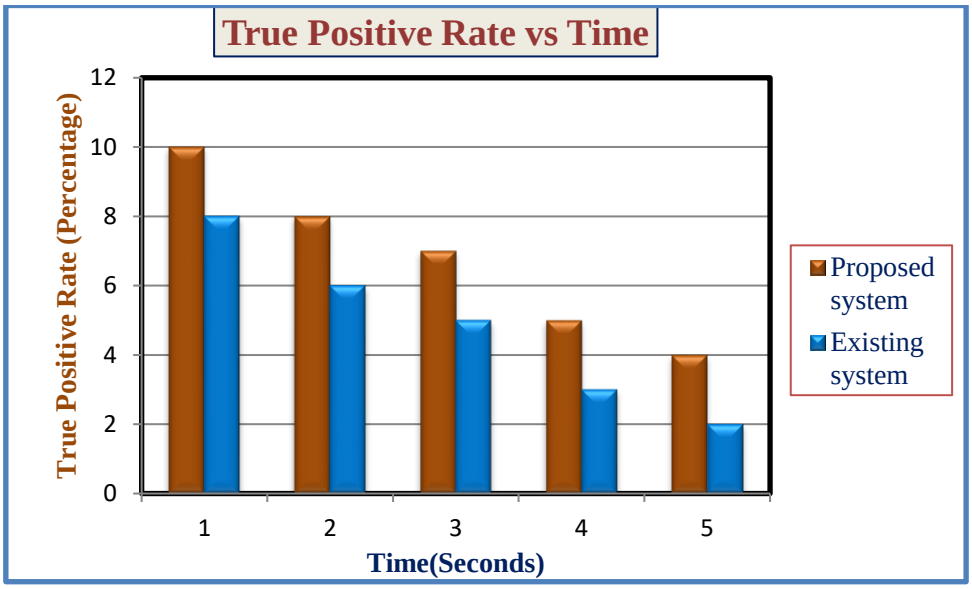

Figure 5.2: True Positive Rate with respect to the time

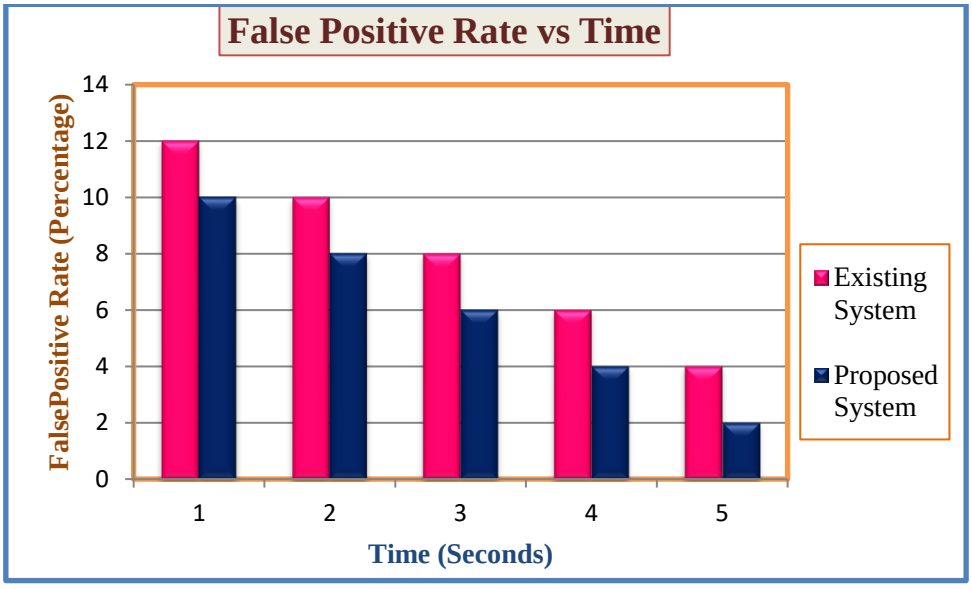

Figure 5.3: False Positive Rate with respect to the time

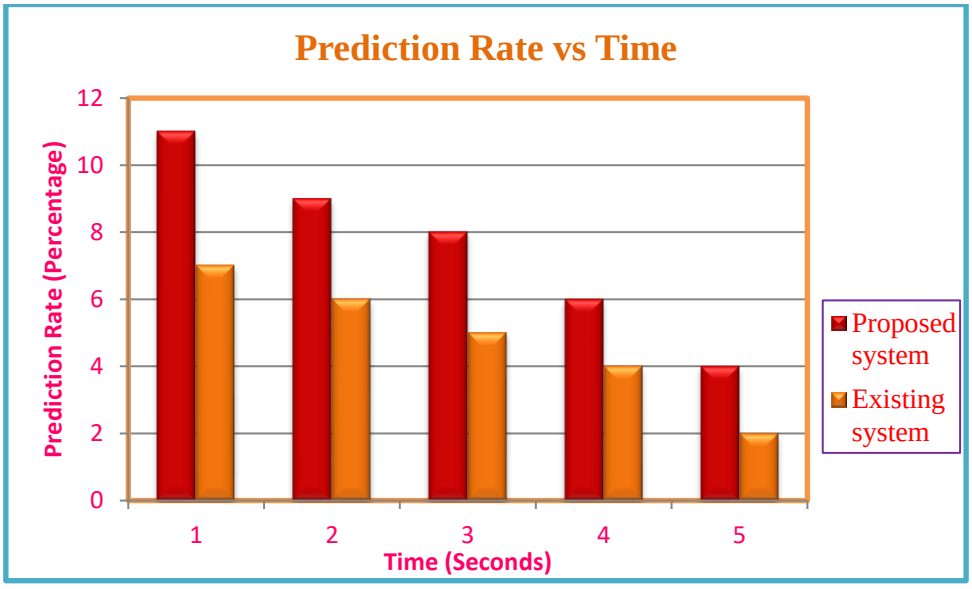

Figure 5.4: Prediction Rate with respect to the time

VI. CONCLUSION AND FUTURE WORK

In this paper prediction model is proposed for detection of the healthy and diseased tomato crops and predicted the disease names along with the solution to cure that disease automatically by using the internet of things based Agri electronic device and the deep learning technologies specifically for the tomato crops. It is implemented in 100 cents land of the tomato crop in the Tirupati surrounding village, Andhra Pradesh state and the results were shown in times of the accuracy and prediction rate, results were shown high when compared with the existing system. In future work the same model can be applied for other similar crops and can test the Agri device with the multiple crops simultaneously.

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