Farmer Awareness and Cost Estimation

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Abstract—In today's modernized world, Internet of Things is restructuring the field of agriculture. Encompassing a wide range of techniques, digital farming is enabled today where a farmer can monitor the field easily with a smart phone. In supply chain management, farmers are the least benefited group; the prices with which the farmers sell are much lower than in the markets. In an attempt to bridge this gap, this paper presents a Farmer Awareness and Cost Estimation (F.A.C.E) system using IoT. The system will determine the prices of the product according to its quality. This will help in boosting the economic conditions of the farmers so that they can have a competitive lead in the market.

Keywords - Agriculture,Harvest Pricing, Internet of Things, Monitoring, Warehouse Management

I. Introduction

India is a country which still relies on agriculture for its economy. Despite the major advancements in science and technology, agriculture remains bereft of it. Though some attempts have been made previously to infuse modern technology into the whole agricultural process, there have been major catastrophes. Be it due to the ignorance of Indian farmers on technology, lack of transparency or inadequate implementation and support of the projects, they have failed miserably. This has led to the country's status quo of farming far behind. Everybody from the farmers, wholesalers, distributors and customers is affected adversely.

To alleviate the problems faced by the farming community, a two-pronged plan of warehouse management and price forecasting is proposed. With the advent of Internet of Things (IoT), the two seemingly disconnected entities can be coa-lesced to form a system that will be able to increase the transparency of the supply chain and reduce unwanted inflation of market prices. IoT can be applied in warehouses to monitor the quality of produce in real time and draw meaningful inferences. Warehouses are a major link in the supply chain, so it is imperative that their contents be monitored with precision. The sensors will monitor different attributes of the harvest and push the readings into the cloud via the internet. The data collected refers to the existing data, from which the quality of the agricultural produce is obtained. The association between the quality and market price is calculated and an appropriate market price for the produce is suggested to the farmers. This will improve the transparency of the whole process, with possibilities of inflating prices corruptly reduced to a minimum.

A. Literature Survey

Lin Zhang, Min yuan, Deyi Tai, Xia Oweixu, Xiang Zhan, Yuanyuan Zhang [1] developed a wireless technology for crop monitoring which supersedes the traditional methods. Sensors were used to measure leaf moisture, soil pH, soil moisture and atmospheric effects. Accordingly, the farmer can organize the irrigation process. The irrigation or water sprinkling is automated. If there is a change in pH value, the farmer is notified about it. Also, real time crop monitoring has been developed. The whole project is developed on wireless sensor network.

Zhao Liqiang, Yin Shouyi, Liu Leibo, Zhang Zhen, Wei Shaojun [2] designed a wireless network application using intelliSense, identification technology and extensive comput-ing and network integration for precision and smart farming. Implementing two different type of nodes, the system acquires information about meteorological information and information about soil such as pH, humidity, temperature,etc. Growth of crops can be recorded using image capture. The nodes come together as a sensor network.

Dr. D.K. Sreekantha, Kavya A.M [3] in an attempt to revamp traditional agricultural methods, emerged with a sys-tem for online crop monitoring enabling features like weed detection, animal intervention, pest detection, crop growth along with soil fertility, temperature, humidity. Complete system is based on WSN and IOT. IOT helps in anytime
, anywhere monitoring of crops just using a mobile phone. Micro controllers are used for automation of systems. On implementing such systems, it can reduce the farming cost and increase the produce to a large extent.

Dr.N.Suma, Sandra Rhea Samson, S.Saranya, G.Shanmugapriya, R.Subhashri [4] implemented a Smart Farming System. The project involves use of remote controlled systems, moisture, leaf wetness, humidity.

Accordingly irrigation systems have been implemented. Any parameters can be controlled by interfacing the sensors, Wifi, camera operated with microcontroller. This system has been developed as a product and can be used by farmers for improved farming.

Anand Nayyar, Vikram Puri [5] created an Agricultural Stick for smart farming. The stick assists the farmers by providing Live Data from the field. It is developed using Arduino, Breadboard paired with various sensors. The product being proposed is tested on Live Agriculture Fields giving high accuracy over 98 percent in data feeds.

Reasearch conducted by Christopher Brewster, Ioanna Roussaki, Nikos Kalatzis, Kevin Doolin, and Keith Ellis [6] suggested on how the IoT can be utilised efficiently to improve the state of agriculture. .It introduces the Farm to Fork concept that has been devised to maximize outputs of farming by implementing IoT methods and reduce waste generated by the same .It currently focuses on dairy, fruit, arable, meat and vegetable supply chain and also shows comparison of the outcome before and after implementation. The main barrier is the little uptake of IoT in agriculture due to negligible reliance of farmers on technology.

Another study conducted by Lida Xu, Ning Liang and Qiong Gao [7] describes a smart warehousing system that strives to achieve better inventory and management control in current warehouses. Wireless communications,portable termi-nals, forklift management are some of the techniques described in the paper.It also proposes use of smart picking sequence and 3d shelf monitoring that can benefit the management and functioning of warehouses. The research suggested Integrated Information Systems rather than standalone databases to make access to data more transparent.

Wen Ding [8] suggested in his study that manual operations in a warehouse are not efficient and time-consuming, with a wide room for errors. IoT can be used for intelligent monitoring and inventory control by using RFID and other sensing devices. As a result of this, all the personnel can control and manage the warehouse conveniently by accessing the data cloud.

Li Juntao and Ma Yinbo [9] concluded that IoT is the future of technology and it is essential to maximize productivity in warehouses. They split the system into three layers. First was the perception layer, consisting of all the sensors which sensed attributes in real time. The second was the network layer which is embodied in the Internet and consisted of wireless networking. The Application layer is the connection of the user with the system and how wants to use it.

Dhananjay Singh and Rahul Desai [10] in their study described on how grains can be stored and their quality main-tained. Wireless Sensor Networks are used to monitor changes in temperature, moisture, heat etc. This data is passed on to the Administrator of the warehouse to keep him updated. Other factors to monitor the quality of grain have been discussed. These factor later affect the prices at which they are sold. The grains are checked using sensors keeping in mind the various factor like color, shininess, odour before distributing it.

A detailed research by Kavya P, Pallavi KN and Shwetha MN [11] in the field of IoT suggested techniques to be used in monitoring of crops in the warehouse using Wireless Sensor Networks (WSN) and Smart Sensing devices. Realtime information was collected from the sensors and pushed into the data cloud. Raspberry Pi was used as the server for this study. The moisture content in the warehouse premises was analyzed so as it should not exceed a certain threshold, which might prove detrimental to the quality of the crop. Temperature and oxygen content were the other quantities measured. Ultrasonic Sound repellers were used to prevent rodents from entering the warehouse.

II. Proposed Work

The proposed system consists of following major blocks as shown in Fig.1 Workflow Diagram.

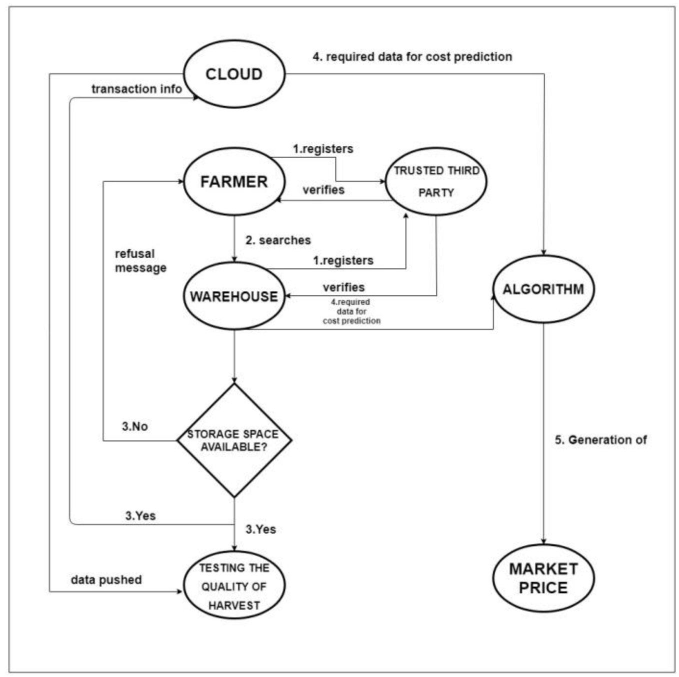

Fig. 1. Workflow Diagram

A. Farmer

The farmer logs into his personal account on the system and searches for details of the warehouses nearest to him. The verification is carried out using Aadhar details, while the authentication is done through email/contact. Upon finding a suitable warehouse, he can place a request to store his harvest, provided that the concerned warehouse has enough space to accommodate the order. The warehouse weighs the harvest and evaluates based on the quality parameters before placing them in the warehouse. With the provision of message intimation, farmers can track the status of their requests easily. On completion, the results of the transaction are stored in the data cloud for future reference.

B. Warehouse

The warehouse administrator is verified and authenticated similarly as the farmer. The warehouse takes appropriate action on the incoming request where the administrator checks the inventory and confirms whether it has enough space to house the harvest. If yes, the administrator initiates the transaction. Before the admission of harvest in the warehouse premises, it is weighed and evaluated on basis of its quality and the current status of the inventory is updated. The transaction with the farmer is successful when the harvest rests in the warehouse. The particulars are updated into the server wirelessly.

C. Server

The server has many roles in the system. It houses the database required for any operations. The inventory relating to each warehouse and the quality of contents resides here. The server keeps record of MSP and boundary values of quality parameter ranges. These values are critical for the functioning of the cost prediction algorithm. The server also receives data from the sensors. It has basic defences against cyber attacks.

D. Algorithm

The algorithm is developed for cost estimation. The quality of the harvest depends on temperature, humidity, foreign mat-ter and the uniformity of grains. These values, alongside the MSP(Minimum Support Price) for that harvest is incorporated into classifying the harvest into different ranges. The output in terms of estimated selling price is generated and pushed into the cloud subsequently. The main aim of developing this algorithm is to ensure that the farmer will always receive a selling price equal to or above than MSP.

III. Implementation details

The implementation is divided into two parts. The first part deals with the activities on the web application. The second part deals with determining the selling price of the harvest based on the quality, which is calculated based on certain parameters.

The farmer or the warehouse administrator registers himself on the web portal.[13] A trusted third party verifies their cre-dentials before authenticating them. The authenticated entities receives appropriate intimation through Short Message Service (SMS). He is now cleared to avail the services of the web application.

A list of warehouses is available to the farmer where he can store his harvest. A search bar is available to ease the process
[14]. Upon finding a suitable warehouse, the farmer can place a bid to have his harvest stored at there. His bid gets added to the request list of that particular warehouse.

The control now shifts to the warehouse. The administrator looks out for any incoming bids from the farmers wanting to store their crops. If the warehouse has enough capacity, the administrator accepts the request. This triggers a change in the farmer's account as well, indicating that his request has been accepted. SMS intimation is sent to the farmer's mobile phone [12].

When the farmer arrives at the warehouse with his harvest, a quality check is carried out with a standard sample. The embedded system apparatus is responsible for calculating the moisture content of the sample, which is factored in the price prediction algorithm. In the process of registering the harvest in the warehouse premises, the uniformity of the grains is evaluated manually and the appropriate class of uniformity is selected. These factors serve as inputs for determining the selling price of that batch of harvest.

The warehouse administrator completes the procedure by approving that the transaction has been completed success-fully. The farmer and the administrator both receive SMS intimation, while an email is also sent to the administrator's account. The final details of the transactions get stored in the logs section, where they can be viewed for future reference.

IV. Conclusion

IoT based systems are replacing traditional systems largely because of their efficiency and least human intervention. The proposed project is developed on the same tracks. The prominent features of the project include determining harvest selling price and increased ease of communication. The biggest challenge in the agricultural supply chain, which is the welfare of farmers, can be solved by this project. The web application also has a regional language support to ensure more usability and compatibility. As more farmers and warehouse collaborate, the project has the potential to scale up to include private vendors and also expand geographically.

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