

Price Setter : Farmers and Sellers Coordinating System

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Abstract— The Sri Lanka is depend on agriculture. Normally farmers bring their harvest to the economic centers. Then end sellers buy their requirements from that economic centers. Therefore the shop owners in economic centers act as a intermediate sellers. With the demand and supply, price of the vegetables are changed by the intermediate sellers. The purpose of this project is created a system to control the supply and demand according to smart way and avoid the black market price. According to simple economics, we can control the price when we handle the supply and demand. we get some details about quantities which farmers willing to bring to the market and quantities which end sellers willing to buy from the market. These details will get before some specific time before they come to the market. After doing analysis from the details that we collected and show them to what is the most suitable economic center which he/she need to go. As well as web application shows the predicted future prices of vegetables using machine learning approaches.

Index Terms— ML-Machine Learning, MLR-Multiple linear regression, UI – User Interface



1 INTRODUCTION

The Sri Lanka is a country which depend on the agriculture. Rice, Vegetables, Fruits are the main foods which we used. Normally farmers bring their harvest to the economic centers such as Dambulla economic center, Thabutegama economic center...etc. Then end sellers buy their requirements from that economic centers. So, the shop owners in economic centers act as a intermediate sellers. After the farmers bring their harvest to the economic center, intermediate sellers which own the shop in in the economic center, buy the vegetables and other stuff from farmers. The end sellers also come to the economic center to buy their selling requirements from the shops in economic center. The farmers need to sell their harvest with good price. The end sellers need to buy their requirements with less price. Also end sellers try to reduce another cost like transportation. Then only they can get good profit from the selling.

But nowadays what happened is, price is handled by these intermediate sellers in economic centers. They try to buy the vegetables and other goods with less price from the farmers. The price is varying according to the two scenarios. When demand is more than supply means, many sellers are coming to the economic center to buy their requirements, but the supply from the farmers is less. Then, intermediate sellers are trying to sell the products with high profit and according to the demand they change the selling price.

When supply is more than demand means, many farmers come to the economic center with their harvest, but the number of end sellers that come to buy their requirement are less. Then intermediate sellers in the economic center try to buy the harvest from the farmers from less price. Because demand is less. It is also not better for farmers. Because intermediate sellers buy their harvest with less price.

Then farmers will not received at least the cost for their harvest. Normally they get bank loans for thir agricultural stuff. Then farmers don't have enough money to pay their loans back.

When intermediate sellers sell with high profit ,then it is affected to the general public. Because end sellers cover the all the cost from the consumers.

This is the one of the major problem in Sri Lanka. At least, intermediate sellers are not caring about the government ordered prices. Government use maximum control price for the goods when need relief to the consumers. As well as government use minimum control price for the goods when need relief to the farmers/producers. Though government order the maximum price, intermediary seller create black market price. For a example, government ordered Rs.150 for one kilogram of onion. But there is a shortage of onion in economic center. Then there is a good demand for onion and they sell the onion for Rs.160(Black market price). Then final sellers add it their transportation cost and other costs and sell it to consumers for Rs.180. But the maximum price which need to sell is Rs.150. We can complain to Consumer Affairs Authority. But actual problem is not the final seller. Problem is with intermediary seller in the economic center. The procedure in the economic centers is make excuse to intermediary seller. Which means, expect for large scale wholesalers (they have their own transportations), seller paid to the market and booked. Then goods are transported by another person. When Consumer Affairs Authority questioning about the keep the stock without selling, already they have a answer with evidence. They can make bill and show which stock is waiting for transportation. So, according to THE CONSUMER AFFAIRS AUTHORITY ACT NO 09 OF 2003, not able to get any legal action. Therefore intermediary sellers become price setter which entity that has the

ability to set its own prices. They can change the price according to the demand. As I mentioned earlier that is finally affected to the general public. They need to pay high value for the goods. But this actual benefit is not going to farmers. It is gotten by intermediary sellers. As well as, when farmer's harvest is huge, then don't have a good price for them at least to cover their cost. The main reason is no way to coordinate the farmers for suitable place to sell their harvest. Another reason is farmers don't have idea which demand is available for that time period. This is a real problem happening now.

2 DEVELOPMENT STAGES

As a solution for to the above problem, mobile application was developed. This mobile application is used to coordinate the end sellers and farmers. The purpose of doing that is control the demand and supply to avoid black market price and suggest the better place for farmers and end sellers to get more profit. Basically, there are two interfaces. One for farmers and another one for end sellers. Both farmers and end sellers have to update some details regarding their future plan about willing to bringing the harvest to economic center/willing to buy from the economic center. Farmers have to update below details;

- which day he/she willing to bringing the harvest to economic center.
- what the varieties of vegetable that willing to bringing.
- what are the quantities willing to bringing, that willing to bring.
- what is the target economic center which hope to go to sell their harvest.

Sellers have to update below details;

- which day he/she willing to buying the vegetables and other stuffs from economic center.
- what the varieties of vegetable that willing to buy.
- what are the quantities willing to buy.
- what is the target economic center which hope to go buy their requirements.

These details are taken by through the mobile application. They should update these details before a specific time. Now we have details regarding the future demand in the economic center and future supply in the economic center. Our goal is avoid the black market price and suggest suitable economic center for the farmers and sellers. We have to answer the two scenarios.

- When demand is more than supply, intermediate sellers maintain the blackmarket price. When demand is more than supply means, many sellers are coming to the economic center to buy their requirements, but the supply from the farmers is less. So, intermediate sellers are trying to sell the products with high profit. Also this situation guide to create a black market price for related vegetable. Problem is with the number of sellers which willing to come to the economic center. But we can coordinate them and suggest another economic center with considering the transportation cost also. This will be helped to control the

demand and avoid black market price.

- When supply is more than demand means, many farmers come to the economic center with their harvest, but the number of end sellers that come to buy their requirement are less. Then intermediate sellers in the economic center try to buy the harvest from the farmers from less price. Because demand is less. It is also not better for farmers. Because intermediate sellers buy their harvest with less price.

After doing analyze by using collected data, we can suggest economic center that suitable for them. Then involuntarily balance the demand and supply. It helps to avoid the black market price and it helps to provide the solution for second scenario also. Which means, farmers can go to the economic center which they can get more profit.

I did survey at the Dambulla dedicated economic center to collect practical information. For a example, data collecting from farmers and end sellers and suggestions for the suitable economic center are should be done before some specific time. Because farmers and end sellers need time to reach the suggested economic center. According to survey, most of the farmers and end sellers are start their journey to come to economic center at night and they hope to reach the economic center early in the morning. I decided 8.00 PM is the most suitable time to end the collecting data and suggest the suitable economic center. Therefore both farmers and sellers should be updated the details before 8.00 PM. Some farmers get loans from the intermediate sellers in economic center for the farming purposes and agree to give harvest back to the that intermediate seller. These type farmers have no other options. They should be gone to that economic center which got the loan.

2.1 Implement Algorithm for analysing

Using the collected details from the farmers and end sellers, need to suggest the most suitable economic center they have to go. For that analysing, Least-cost transportation model was selected. In this mathematical model used to balance the demand and supply, based on the cost for the transportation.

When supply is more than demand means, many farmers come to the economic center with their harvest, but the number of end sellers that come to buy their requirement are less. Then farmers should be coordinated.

	Demand	Farmer01	Farmer02	Farmer03
Mar- ket01	5000kg	15	23	11
Mar- ket02	2000kg	12	10	17
Mar- ket03	1800kg	8	6	2
		300kg	450kg	375kg

Table 01

	Total Demand for related economic center. This can be calculated from the updated details from the end sellers.
	Cost for the transportation from farmer's place to the economic center. This is collected by the registration process. When create an account, mobile application ask to mark the location of farmer. Then calculated the distance to the each economic center and these values are considered as initial cost values.
	Quantity of farmers willing to bring to the economic center. Farmers are updated these values before come to the economic center.

Now according to the cost for the transportation, this coordination is done. For a example, least cost is 3, then farmer 03's 375kg is dedicated to Market 03. Then least cost is 6. Then farmer 02 is dedicated to market 03. These process is repeated until the satisfy the demand in economic center. If any farmer get loan from the intermediate seller, then cost for the related economic center is set as 0. Then it will be the least cost and that farmer will be assigned for the related economic center. Using these process farmers are coordinated and involuntarily balance the demand and supply.

When demand is more than supply means, many sellers are coming to the economic center to buy their requirements, but the supply from the farmers is less. Then end sellers should be coordinated.

	Supply	Seller01	Seller02	Seller03
Market01	5000kg	15	23	11
Market02	2000kg	12	10	17
Market03	1800kg	8	6	2
		300kg	450kg	375kg

Table 02

	Total Supply for related economic center. This can be calculated from the updated details from the farmers.
	Cost for the transportation from end seller's place to the economic center. This is collected by the registration process. When create an account, mobile application ask to mark the location of end seller. Then calculated the distance to the each economic center and these values are considered as initial cost values.
	Quantity of end sellers willing to buy from the economic center. End sellers are updated these values before come to the economic center.

Now according to the cost for the transportation, this coordination is done. For a example, least cost is 2, then seller 03 will come to the buy 375kg to Market 03. Then least cost is 6. Then seller 02 will come to the market 03. These

process is repeated until the satisfy the supply in economic center. This is math behind the least-cost transportation model. For the analysing part, this model was used. This algorithm is applied for each vegetable separately.

2.2 Develop the mobile application

Mobile application was developed by Java. Basically, registration process was needed for the both farmers and sellers. Logging authentication is done by firebase authentication. Authentication User Id was used as the identity for both farmers and sellers. Firebase Real-time database was used to save the data that get from farmers and end sellers. After getting the details, analysing process is done using above described algorithm. Then output is uploaded to the real-time database. These analysing is the main object. Except to that object, there are other features also included to this mobile application.

- Both farmers and sellers can update their profiles.
- There is a price list which contains the price of vegetables and other stuffs in the economic center.
- Virtual market –This virtual market is the solution for the another issue that found while doing the survey. Farmers need to go to more shops for asking to sell their harvest. It take more time and it affect to traffic inside the economic center. Therefore, the farmers can update the details about their harvest to the virtual market. Then intermediate sellers can access these data from the web application.
- Past statistics also can check. There is a feature for that also.

User friendly interfaces were implemented to achieve all these features. In the registration process, users have to mark their location and automatically calculate the distances to economic centers.

2.3 Implement machine learning model for predictions

When use above mobile application, we can collect big data set about the demand, supply, prices of vegetables and so on. All tables and figures will be processed as images. Using these big data, we can predict the future demand, future supply, future prices and so on.

Multiple linear regression (MLR) is a statistical technique that uses several explanatory variables to predict the outcome of a response variable. The goal of multiple linear regression (MLR) is to model the linear relationship between the explanatory (independent) variables and response (dependent) variable. MLR is used extensively in econometrics and financial inference. For the prediction, multiple linear regression model is used. Below show the equation for the MLR.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n$$

With the current situation, It is difficult to find the data set related to vegetable prices in Sri Lanka. The dataset that I found was prices of set of crops in India.

There are 3 variables affect for the price according to data set.

- Month
- Year
- Rainfall

These three parameters were used as variables affect to the price. 30% of dataset is selected as a test data and another 70% of dataset is selected as a training data. Below show one of the example of the training process and it based on 'Bajra' data set(Bajra.csv).

- Preprocessing of the data set was done. Import libraries, Read data, Checking for missing values and Checking for categorical data were done during the data preprocrrsing.
- Trained the data set and find the constatnt and coefficient values.

Constant = -7852.518878378196

Coefficients = [0.08135242 3.96376442 0.00928807]

- Use trained machine learning model to predict the future prices.

Test Data	Predicted Data	Error
131.5	130.919868	0.44 %
134.4	133.498180	0.67 %
153.2	143.380301	6.40 %

Table 03

Machine learning model provided better accuracy for the predictions. sklearn was used as a main library. Because it provides linear regression model, preprossecing operations and so on. For the training process, linear regression models that provided by the sklearn was used. Another all crops also follow the same procedure to implement the machine learning model.

2.4 Develop the Web application

Using created machine learning model, web application was developed by using html, java script and CSS. For the backend, python was used with flask mini framework. Web application shows that crops that have maximum prices, crops that have minimum prices, predicted prices of crops for the next year. Also these prices are graphically represented by using graph. Connecting machine learning model to web application was done by through the flask framework.

3 CHALLENGES

The main problem was collecting the information and data that related to the implementation of analysing algorithm. Because it would be more practical approach. The survey was done at Dambulla dedicated economic center. But there are other economic centers also. For the more accurate implementation, that informations also important. But with this pandemic situation it is difficult to find the data. For the future price predictions, I had to use data set from india which related to the crops.

Home distraction is the one of the main problem, which happened when work from home. Therefore, time managment was diffculted. As well as infrastructure for the

work from is less. It also main challenge that I faced. There are many mathematical models for the transportation model. Therefore, finding better mathematical model was a big change.

4 USER INTERFACES

4.1 UI of the mobile application

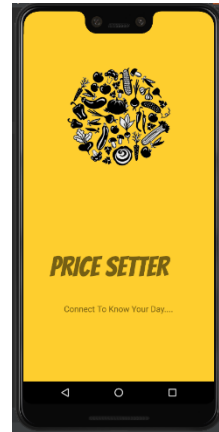


Figure 01 – Welcome Screen

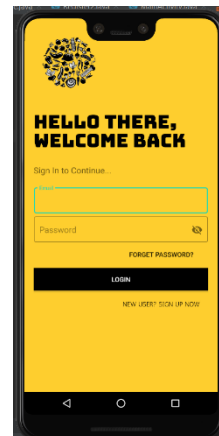


Figure 02 – Logging form

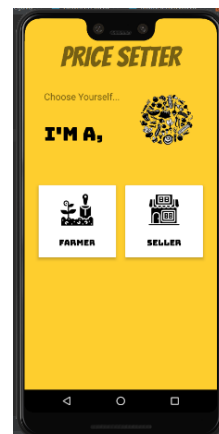


Figure 03 – Selector for farmer or seller

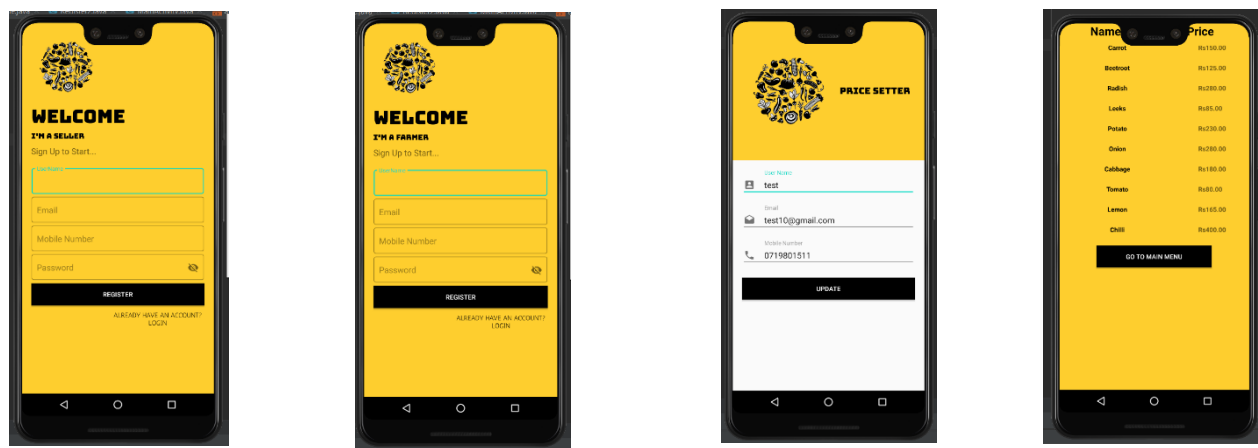


Figure 04 – Registration form for end sellers and farmers.

Figure 07 – These are the menu bar options. Left side show the profile and it can be updated. Right side shows the price list in the economic center.



Figure 05 – Mark the location on map and automatically calculate the distance to the economic centers

Figure 08 – Left side shows the past statistics. Right side shows the virtual market. Farmers can update about their harvest to virtual market.

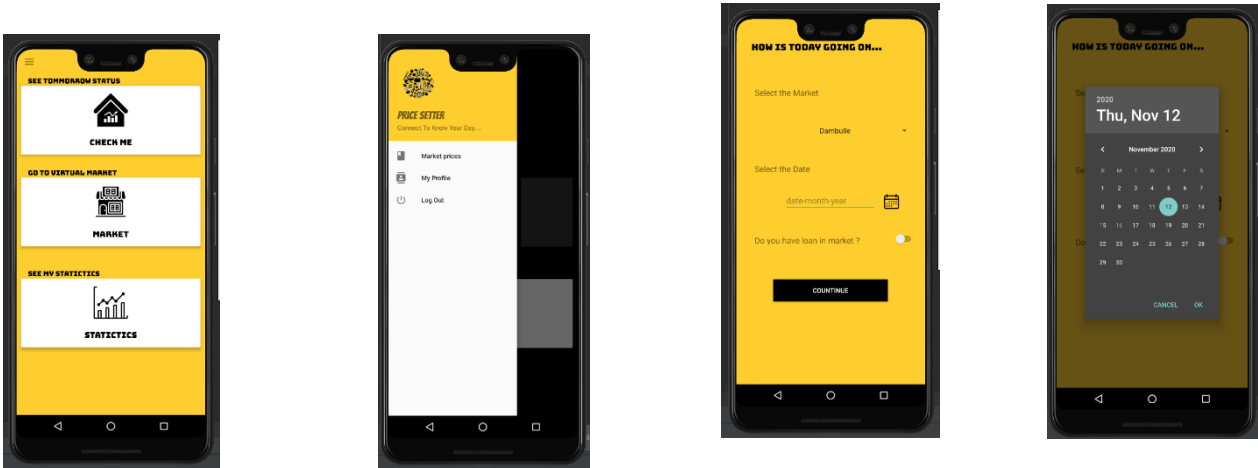


Figure 06 – Left side shows the main menu and Right side shows the menu bar.

Figure 09 – This interface for start the getting details for the analysing process.

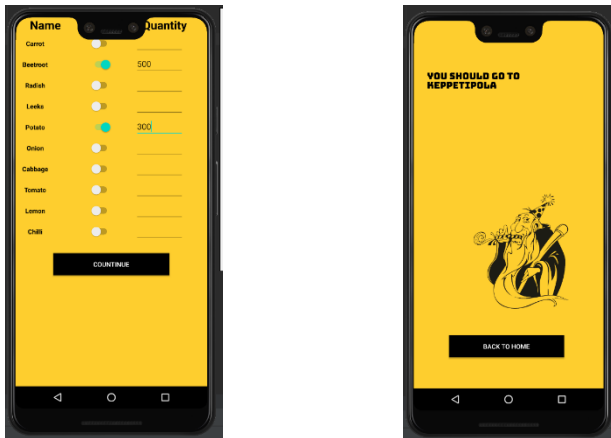


Figure 10 – Left side shows the getting the details about vegetable and quantities which farmers willing to bring or end sellers willing to buy. Right side shows the final output after the analysing.

4.2 UI of the Web application

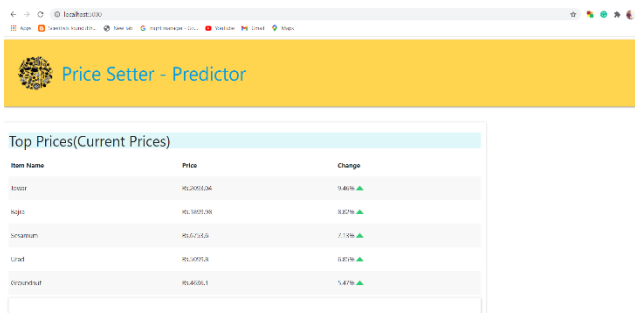


Figure 11 - Crops that have maximum prices

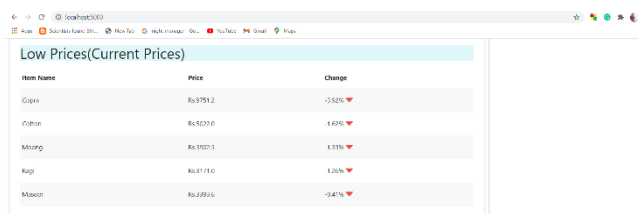


Figure 12 – Crops that have minimum prices

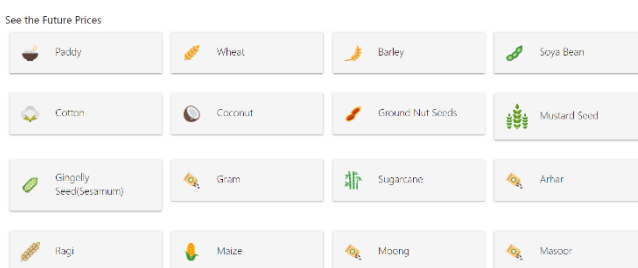


Figure 13 – List of Crops which have predicted values

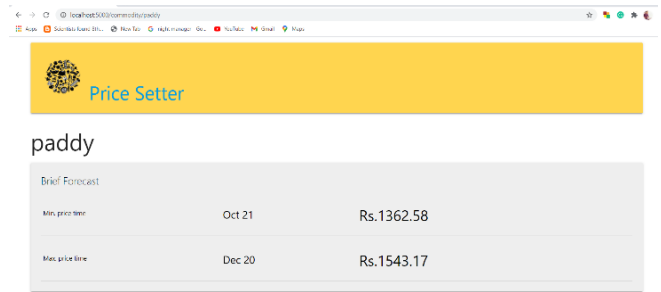


Figure 14 – Maximum and Minimum prices related to crop within next year.

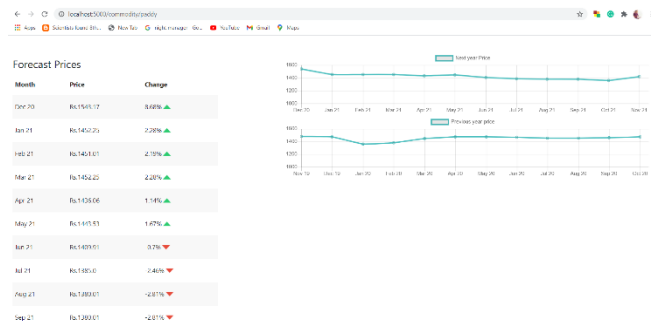


Figure 15 – Represent the predicted prices of crop within next year. It also graphically represent. This figure 14 and figure 15 is related to the Paddy. Same template use for all other crops.

5 FUTURE IMPLEMENTATION

5.1 Implement Algorithm for analysing

I did the survey for data collecting only at the dambull dedicated market. For better practical data, the survey should be done for all other economic centers also. As well as efficiency of the algorithm is less. Algorithm optimization method would be used to reduce the analysing time. Multi threading also not possible. Therefore, I will be looking for some approach which can use multi threading also.

5.2 Develop the Algorithm for prediction

In this project only consider 3 parameters which affect the price. For better prediction, Number of parameters will be increased. Because many variables affect the price. I used multiple linear regression for this predictions. Instead of that, there are some other methods also.

- Price prediction using Back Propagation Neural Network
- Price prediction using Radial Basis Function Network
- Price prediction using neural network based on Genetic Algorithm

With more parameters, I will try to implement a model using above methods.

5.3 Add QR code scanning system

When farmers reach the economic center, they can scan the economic center. When QR code is applied in shops in economic center, administration can access the daily actual transactions and it is helpful for the taxation process.

Because most of the intermediate sellers hide their actual transaction to avoid the income tax. This process is solution for that also.

5.4 Develop the web application

I will implement the admin panel for the access the virtual market. As well as add the update feature of current prices and other informations.

5.5 Develop the Virtual Farmer's Assistant

I hope to develop virtual farmers assistant which provide agricultural plans, cost analysing...etc.

6 PUBLISH THE MOBILE APPLICATION

If we publish this mobile application by ourself, There is a major risk. Because this application is requested the details from the farmers and sellers. But they may be don't like to give their details. We don't know all the farmers and sellers updated their quantities to the profile. So this affect to final analysing result. Because of that we can represent the accuracy using indicator which shows how much accurate the predicted results. (Manually enter the average farmers and sellers come to the market (Available at Economic center records)and compare with profile which updated by the farmers and sellers).

If we publish through the Government When we publish this system through the Government, updating this quantities make as the compulsory. And also need to give understand about what are the benefits of the update their details. Then they will update their profile, because they like to get more profit. Registration process also can be done through the government with unique registration number. This way is give more accurate results.

7 CONCLUSION

This is the very first system to solve the black market price mafia in economic centers. This project will help to both farmers and sellers to achieve their personal goals. As well as the finally this affects to general public. This system is coordinate both farmers and sellers and show them to what is the most suitable place for their purpose. In this project, deal with farmers and sellers using user friendly mobile app and web application.

Basically, Collect the data before the come to the market and show them to is it good or not and what is the better place which he/she can earn more profit. In this,

transportation cost and other cost which related to selling procedure is also considered.

Now both farmers and sellers achieve their goals. Because farmer need good price. If there is more supply in the market, he will get less profit. But already he knows the situation and he can try another economic center and get profit. If there is a more demand in the market, sellers happen to buy things with high price. But now he know which economic center is more suitable to get more profit.

These coordinating system balance the market surplus and market shortage. Then ability of the changing price of the goods by the third party is reduced, because we already control the supply and demand.

Web application also important. Because it represent the future prices. Then farmers can plan their plantation according to time period which they can get more profit. People can learn more details who are willing to farming vegetables prices and the time period etc.

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