WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Mandi Cast: AI-Based Crop Price Forecasting and Sell Advisory System

Mrs. M. Manimegalai[1], Sanjay B[2],Siddarth J[3],Udayabhaarathi K[4]

Department of Computer Science and Engineering, Bachelor of Engineering, Sri Shakthi Institute of Engineering and Technology, Coimbatore-641062

ABSTRACT :

Mandi Cast is an AI-powered web application developed to forecast the daily wholesale (mandi) prices of major crops and to advise farmers whether to sell immediately or wait for a better price. In conventional agricultural marketing, farmers learn the price only on the day they reach the mandi, with no indication of the expected trend, and are therefore often forced to sell at low prices to intermediaries.

The proposed system collects historical variety-wise daily prices from the Government of India open data platform (Agmarknet / data.gov.in) and merges them with district-level weather data from OpenWeatherMap. Seven crops across five mandis are modelled using two complementary methods: a seasonal ARIMA model, SARIMA(1,1,1)(1,1,1,7), and an XGBoost regressor built on lag prices, rolling averages, calendar features, rainfall and temperature. For each crop–market pair both models are evaluated on a 30-day hold-out using RMSE, MAE and MAPE, and the model with the lower MAPE is saved, giving 35 deployed models.

A rule-based recommendation engine converts the seven-day forecast into SELL NOW, WAIT or STABLE advice with a confidence score. The system is delivered through a FastAPI backend and a React dashboard offering OTP-based login, an animated market carousel, price-trend sparklines and SMS price alerts. A preliminary evaluation on synthetic demo data gave a mean MAPE of 3.29% for the selected models. Mandi Cast thus converts raw price records into a simple, timely decision for farmers. Keywords: Crop Price Forecasting, SARIMA, XGBoost, Mandi Prices, Sell Advisory, Agricultural Decision Support, FastAPI, React.

INTRODUCTION:

Agriculture is the main source of livelihood for a large part of India's population, yet the farmer is often the weakest link in the price chain. Crops such as tomato, onion, potato, chilli, wheat, cotton and soybean are sold through regulated wholesale markets called mandis, where prices change daily with arrivals, demand, weather and season. A farmer who harvests today usually cannot tell whether the price will rise or fall in the coming week, and so the decision of when to sell is made on guesswork or on the advice of a trader who benefits from the sale.

In traditional practice, price information comes from word of mouth, local brokers, or a phone call to the mandi. These sources show only today's price, not the expected trend, and they differ from person to person. Farmers may therefore sell perishable produce just before the market recovers, or hold produce too long and lose value through spoilage. Government portals such as Agmarknet and data.gov.in publish daily prices, but they present historical records without prediction and are difficult for farmers with limited technical experience to use.

The proposed Mandi Cast system addresses this problem by combining open price data, weather data and two complementary forecasting methods, SARIMA and XGBoost. Instead of a complicated chart, the system shows a single recommendation – SELL NOW, WAIT or STABLE – with the expected price change and a confidence level. Mandi Cast couples a FastAPI service with a React web interface, OTP-based login and SMS alerts, so that forecasting results reach the farmer in a simple and usable form.

OBJECTIVE:

- To develop an AI-based web application that forecasts mandi prices of major crops for the next seven days.
- To combine historical Agmarknet price data with weather and seasonal features for improved prediction.
- To train SARIMA and XGBoost models for each crop–market pair and automatically select the one with the lower MAPE.
- To convert forecasts into a clear SELL NOW, WAIT or STABLE recommendation with a confidence score.
- To provide a simple farmer-friendly dashboard with OTP login, market selection and price-trend visualisation.
- To deliver price alerts through SMS so that farmers receive advice without opening the application.

LITERATURE SURVEY:

1. **Box, Jenkins, Reinsel and Ljung:** formalised the ARIMA and seasonal ARIMA family of models for time-series forecasting. Their work shows that differencing and seasonal terms capture repeating weekly and yearly patterns, which makes SARIMA a standard baseline for price series[1].
2. **Adanacioglu and Yercan:** applied a SARIMA model to wholesale tomato prices in Turkey and showed that it captures strong seasonality and gives

useful short-term forecasts, supporting its use for perishable agricultural commodities[2].

3. **Chen and Guestrin:** introduced XGBoost, a scalable gradient-boosted tree system that handles non-linear relationships and mixed features efficiently, and has become a leading method for tabular and lag-feature forecasting problems[3].
4. **Jha and Sinha:** developed neural-network models for agricultural price forecasting and reported better accuracy than traditional time-series methods, showing the value of machine-learning approaches for farm commodity prices[4].
5. **Ahumada and Villalobos:** reviewed planning models in the agri-food supply chain and highlighted that the timing of sale and storage decisions strongly affects farm income, which motivates decision-support tools that convert forecasts into advice[5].

METHODOLOGY:

1. **Data Collection:** Historical variety-wise daily prices of seven crops (tomato, onion, potato, chilli, wheat, cotton and soybean) are downloaded for five mandis from the data.gov.in API. Daily rainfall and temperature for the district of each mandi are collected from OpenWeatherMap One Call 3.0 with caching to respect the 1,000-calls-per-day limit.
2. **Data Merging and Feature Engineering:** Price and weather records are merged by date, missing days are filled, and features are created: lag_7, lag_14, rolling_mean_7, month, day_of_week, is_harvest_season, rainfall and temperature.
3. **Model Training:** For every crop–market pair, a SARIMA(1,1,1)(1,1,1,7) model and an XGBoost regressor are trained on the historical series, keeping the latest 30 days as a hold-out set.
4. **Model Evaluation and Selection:** Both models are evaluated using RMSE, MAE and MAPE on the hold-out set. The model with the lower MAPE is saved as a joblib file together with its metadata, producing 35 saved models.
5. **Forecasting and Recommendation:** The API loads the saved model, predicts the next seven days and compares the day-7 price with the latest price. A rise above 5% gives WAIT, a fall below 5% gives SELL NOW, and otherwise the advice is STABLE. Confidence is computed as $100 - 3 \times$ MAPE, limited between 50 and 97.
6. **Delivery to the Farmer:** The React dashboard shows the advice, price, market carousel and sparkline trends. Users are verified by a mobile OTP and can subscribe to SMS alerts for a chosen crop and market.

EXISTING SYSTEM:

1. **Price Known Only for Today:** Farmers receive the current mandi price through brokers, calls or notice boards, without any indication of the expected trend.
2. **Dependence on Middlemen:** Lack of independent price information makes farmers dependent on traders, who may quote lower prices.
3. **Data Without Prediction:** Government portals such as Agmarknet publish historical and current prices but do not forecast or advise.
4. **Complex Interfaces:** Existing portals present large tables and charts that are difficult for farmers with limited technical experience to interpret.
5. **Single-Method Forecasting:** Studies typically use one model type, which may not suit every crop and market.
6. **No Timely Alerts:** Farmers are not notified when a price is expected to rise or fall, so selling opportunities are missed.

PROPOSED SYSTEM:

1. **Seven-Day Price Forecasting:** Daily prices of seven crops in five mandis are forecast for the next week using weather and seasonal features.
2. **Dual-Model Selection:** SARIMA and XGBoost are both trained for each crop–market pair and the lower-MAPE model is automatically selected.
3. **Clear Sell/Wait Advice:** A threshold rule converts the forecast into SELL NOW, WAIT or STABLE with a confidence score.
4. **Farmer-Friendly Dashboard:** A React interface with large text, market carousel, count-up price display and sparkline trends supports quick decisions.
5. **OTP-Based Access:** Mobile-number OTP verification and logout protect user access and link alerts to a verified number.
6. **SMS Price Alerts:** Subscribed users receive short messages with the crop, market, price and advice.

SYSTEM REQUIREMENTS:

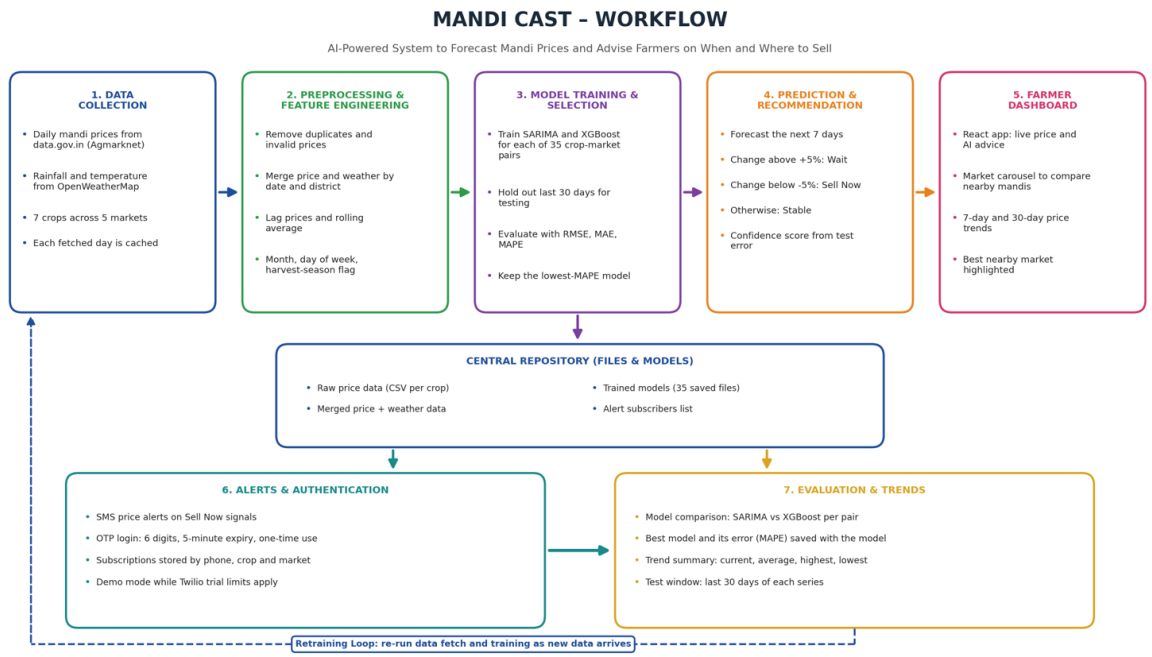
Hardware Requirements:

- Processor: Intel Core i5 or higher or equivalent.
- RAM: Minimum 8 GB.
- Storage: 10 GB or more of free space.
- Display: Standard HD display or higher.
- Network: Stable internet connection for data download, OTP and SMS.

Software Requirements:

- Operating System: Windows 10/11, Linux or macOS.
- Frontend: React, Vite, react-router-dom, Recharts, lucide-react, HTML, CSS, JavaScript.
- Backend: Python 3.10+ with FastAPI and uvicorn.
- Machine Learning: pandas, scikit-learn, statsmodels (SARIMA), XGBoost, joblib.
- External Services: data.gov.in API, OpenWeatherMap One Call 3.0, Twilio SMS.
- Browser: Google Chrome, Mozilla Firefox, Microsoft Edge, or Apple Safari.

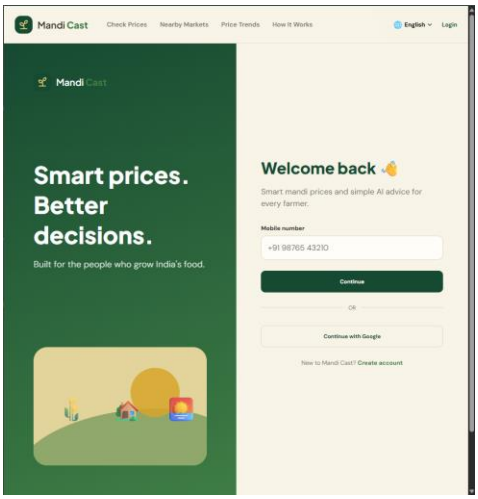
PROCESSING:



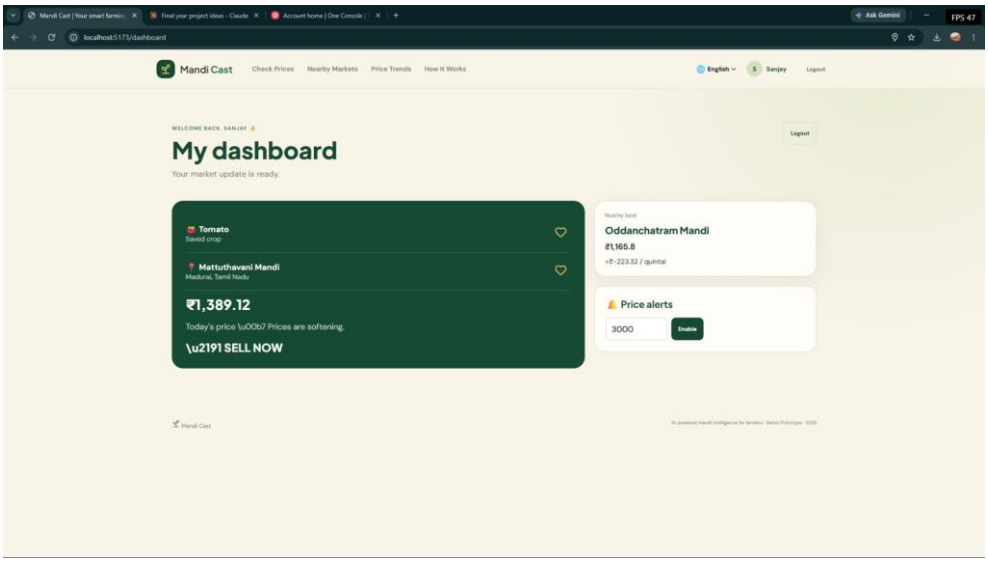
MODULES:

1. **Data Collection Module:** Downloads variety-wise daily mandi prices from data.gov.in for seven crops and five mandis and stores them as raw CSV files.
2. **Weather Integration and Feature Engineering Module:** Fetches rainfall and temperature from OpenWeatherMap, merges them with prices and builds lag, rolling, calendar and harvest-season features.
3. **Forecasting Model Training Module:** Trains SARIMA and XGBoost models for each crop–market pair, evaluates RMSE, MAE and MAPE on a 30-day hold-out and saves the best model.
4. **Recommendation Engine:** Converts the seven-day forecast into SELL NOW, WAIT or STABLE advice using a 5% threshold and calculates a confidence score.
5. **FastAPI Service Module:** Serves crops, markets, insights and trends through REST endpoints and loads the saved models at request time.
6. **OTP Authentication Module:** Generates, sends and verifies six-digit OTPs for mobile login and supports logout, with a demo mode for testing.
7. **Farmer Dashboard Module:** Provides crop selection, an animated market carousel, price display and sparkline trend pages in the React interface.
8. **SMS Alert Module:** Stores alert subscriptions and sends SMS messages with price and advice for the selected crop and market.

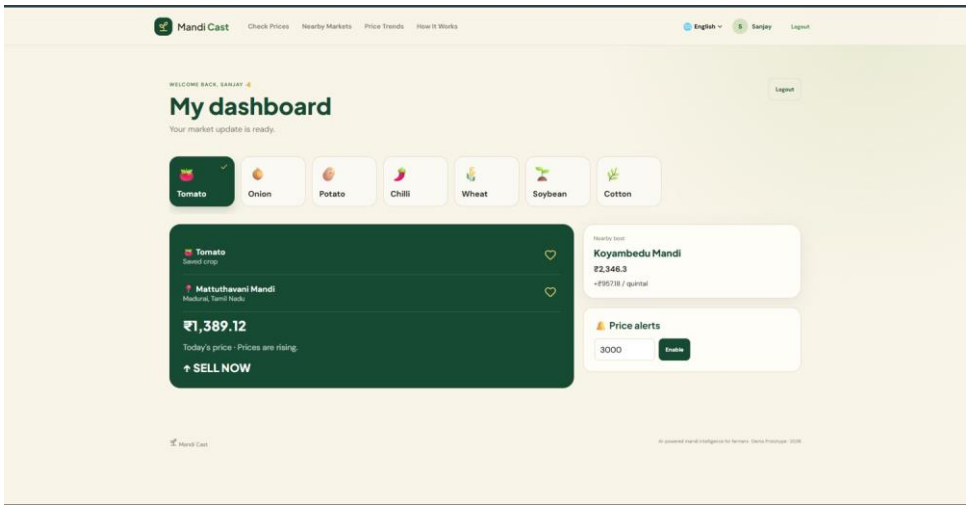
User Authentication (Mobile Number and OTP) Interface:



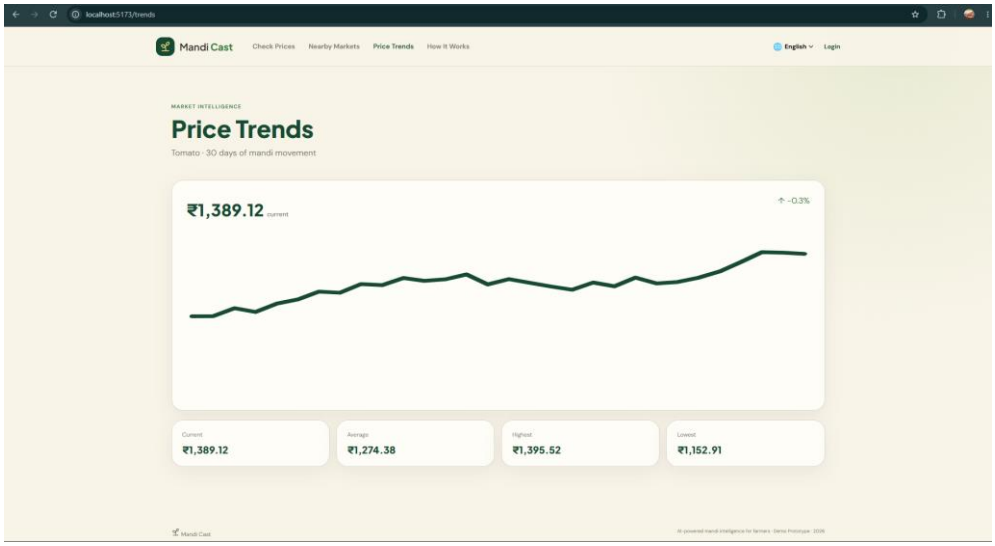
Farmer Dashboard – Crop Selection and Sell/Wait Advisory:



Market Carousel – Switching Between Mandis and Crops:



Price Trends – Recent Price History and Sparklines:



RESULTS AND DISCUSSION:

The pipeline was evaluated on synthetic demo data resembling seven crops and five mandis over five years (1,825 daily records per series), with the final 30 days held out for testing. Across the 35 crop–market pairs, the mean MAPE was 3.97% for XGBoost and 5.50% for SARIMA. After selecting the better model for each pair, the mean MAPE was 3.29%, and 32 of the 35 pairs had a MAPE below 5% (maximum 7.77%). XGBoost was selected for 24 pairs and SARIMA for 11 pairs, which shows the benefit of using both model families.

By crop, the mean MAPE of the selected models was 2.49% for cotton and wheat, 2.86% for soybean, 3.59% for potato, 3.72% for chilli, 3.79% for onion and 4.10% for tomato, indicating that perishable and volatile crops are harder to forecast. These figures come from synthetic data and are preliminary; they demonstrate that the pipeline works, and real-market accuracy will be reported after retraining on live data.

CONCLUSION:

Mandi Cast provides a practical and scalable approach to a long-standing problem in agricultural marketing: farmers lack reliable information on future prices. By combining open mandi price data, weather information, SARIMA and XGBoost, the system produces seven-day forecasts for seven crops across five mandis and selects the better model for each crop–market pair. A simple threshold rule turns each forecast into SELL NOW, WAIT or STABLE advice with a confidence score.

The full-stack implementation, with a FastAPI backend, React dashboard, OTP login and SMS alerts, demonstrates a complete pipeline from data to decision. The present evaluation uses synthetic demo data and must be repeated on live data.gov.in and OpenWeatherMap data before accuracy claims are made. Future enhancements include automatic retraining, more crops and mandis, regional-language and voice or WhatsApp advice for farmers without smartphones, probabilistic price ranges, and the use of arrival volumes and fuel prices as additional features.

REFERENCES:

[1] G. E. P. Box, G. M. Jenkins, G. C. Reinsel and G. M. Ljung, Time Series Analysis: Forecasting and Control, 5th ed. Hoboken, NJ, USA: Wiley, 2015.

[2] H. Adanacioglu and M. Yercan, "An analysis of tomato prices at wholesale level in Turkey: An application of SARIMA model," Custos e @gronegócio on line, vol. 8, no. 4, pp. 52–75, 2012.

[3] T. Chen and C. Guestrin, "XGBoost: A scalable tree boosting system," in Proc. 22nd ACM SIGKDD Int. Conf. Knowledge Discovery and Data Mining, San Francisco, CA, USA, 2016, pp. 785–794, doi: 10.1145/2939672.2939785.

[4] G. K. Jha and K. Sinha, "Agricultural price forecasting using neural network model: An innovative information delivery system," Agricultural Economics Research Review, vol. 26, no. 2, pp. 229–239, 2013.

[5] O. Ahumada and J. R. Villalobos, "Application of planning models in the agri-food supply chain: A review," European Journal of Operational Research, vol. 196, no. 1, pp. 1–20, 2009.

[6] R. J. Hyndman and A. B. Koehler, "Another look at measures of forecast accuracy," International Journal of Forecasting, vol. 22, no. 4, pp. 679–688, 2006, doi: 10.1016/j.ijforecast.2006.03.001.

[7] Department of Agriculture and Farmers Welfare, Government of India, "Variety-wise Daily Market Prices Data of Commodity," Open Government Data (OGD) Platform India, data.gov.in.