

# Digital Technology for Farmers through CCMM System

Dr. Challa Madhavi Latha, Dr. K.L.S. Soujanya and  
Vijaya Kumar Koppula

**Abstract---** Agriculture is one of the major sectors in India. The Agriculturist is the backbone of the sector but he is underprivileged in India. The improvement of the farmers' economy will increase the nation production and economy. Therefore nation Gross Domestic Product (GDP) also increases. To materialize this, the proposed model Cattle, Crop Marketing Monitoring (CCMM) system is to create awareness among farmers in using technology in farming. The proposed CCMM system can monitor the health of cattle and crop along with market segments status. CCMM system can check the health of cattle, moisture content of the soil, disease identification of plants based on images; know the market value of the crop in various areas. Farmers will be benefited by regular health checking of cattle with the help of IoT devices. Avoid the loss of crop by continuous monitoring of crop. Keep away the middle man in marketing the product. Moreover the CCMM system will help farmers in improving production and their by India GDP shall have steady increase.

**Keywords---** Cattle Monitoring System, Crop Monitoring System, Market Segments, Agriculturist, Economy.

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## I. INTRODUCTION

In India agriculture sector employs more than 50 percent of the workforce and country's Gross Domestic Product (GDP) is around 17 to 18 percent. Currently Indian farmers are rapidly adapting innovative mechanizations compared to the recent past (The Economic Survey 2017-18). The agricultural sectors are providing the employment of two-thirds of working population in India while other sectors have failed to generate more employment opportunities. Agriculture sector is feeding the emerging growth of people. Therefore, unless there is continuous production of agricultural products and marketed properly, the food crisis is likely to arise. The agriculture sector associated with livestock activities (such as cattle farming, poultry, fishing etc.) is the major revenue collecting sector for state and central government budgets from the first five year plan. Indian railways are getting handsome revenue for the transportation of agricultural products (Economicdiscussion.net).

Agriculture sector is playing a major role to feed the people in a healthy manner. In the recent past this sector already achieved safety, health, security and sustainability of production by applying non digital technologies like manual field operations, plant breeding and animal breeding and traditional farming methods (Roussey et. al., 2019).

Globally, 12 percent of the land has been using for cropping or farming (Faostat, 2019). Fields are two types one is farming land and the other is unmanaged land. The size of farming land could depend on the modernization level of cultivation, finance, tradition and geographical conditions of the country (Lesiv et. al., 2019; Fritz et. al., 2015; Graesser and Ramankutty, 2017). However, with the concern of more productivity to feed the growing population

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Dr. Challa Madhavi Latha, Dept. of CSE, CMR College of Engineering & Technology, Hyderabad. E-mail: saidatta2009@gmail.com  
Dr. K.L.S. Soujanya, Dept. of CSE, CMR College of Engineering & Technology, Hyderabad. E-mail: souj47@gmail.com  
Vijaya Kumar Koppula, Dept of CSE, CMR College of Engineering & Technology, Hyderabad. E-mail: vijaykoppula@gmail.com

and to face the environmental challenges, still there is a need to transform from traditional farming to smart farming.

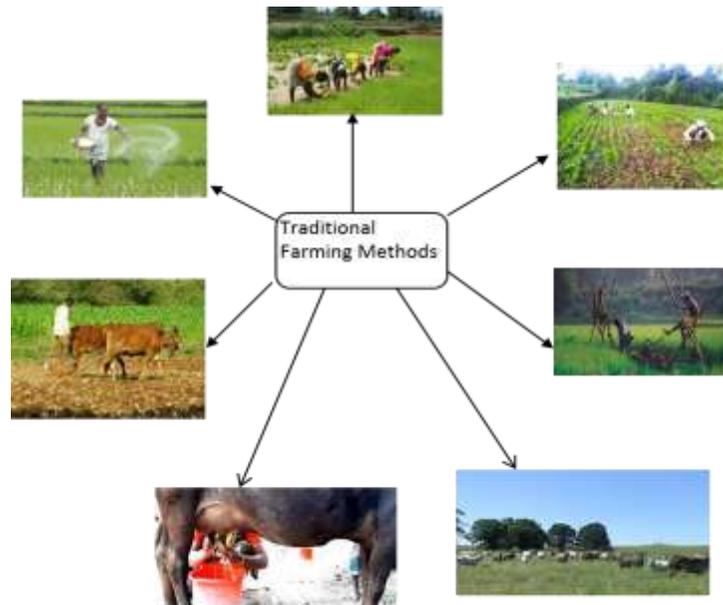


Figure 1: Traditional Farming Methods



Figure 2: Digitalization of Farming

Further, there is a need to monitor the field parameters such as crop variety, growth and health of crop, and formation of yield. The smart farming can manage the large fields on various climate conditions, and also it promises maximize the efficiency and minimize the environmental impacts of the farming (Wolfert et. al., 2017; Walter et. al., 2017). Monitoring of farming products is needed with various applications such as monitoring of soil moisture, recording the temperature changes, monitoring the moisture on air, monitor the moving of cattle, infrastructure and supply chain management, marketing management of agricultural products.

Agricultural marketing is considered as set of activities which are involved in transporting the products from farming point to consuming point. Marketing management of agricultural products are taken care of government of India through several central government organizations such as commission for farming cost and prices, Jute corporation of India, Food corporation of India (FCI), and other marketing bodies. The major problems of agricultural marketing in India contains lack of literacy, transportation, unity, storage, financial resources, several intermediary bodies, lack of awareness, corruption, lack of market bulletin, quality related issues etc. The problems of agricultural marketing can solve by eliminating the middlemen, providing finance, storage facilities, transportation, training, insurance, etc. The development of Indian economy can accelerate by agricultural marketing as applying the dynamic functions. Hence it is termed as the most significant multiplier of agricultural improvement strategies such as optimum output, income growth in farming, market spreading, increase National Income, better employment and living.

## II. LITERATURE REVIEW

The agricultural production can be optimized by digitizing the agriculture. Dawkins (2017), Yeates (2017), Balafoutiset. al., (2017), Busseet. al., (2015) argued and addressed that the social concerns about farming, livestock welfare, origin of food tracing, ecological effect on various farming practices.

Digitalization is additionally anticipated to improve exchange of knowledge by using pervasive information and monitor the disputes and calamities in farming sectors (Daum et. al., 2018; Eichler and Dale, 2019; Stevens et. al., 2016). Widespread of the agricultural sectors has been recorded as greater in the global for the last two decades. For example, innovative technologies has been used for agricultural farming (Bramley, 2009), and lesser degree of technologies has been used for cattle farming (Borchers and Bewley, 2015; Eastwood et. al., 2017).

In the view of technological and organizational perspective the challenging domain for smart farming is agricultural production (AIOTI 2015; Jayaraman et. al., 2016; Verdouw et. al., 2016; Talavera et. al., 2017; Verdouw et. al., 2017). In smart farming the living objects (for example crop, cattle, soil, and perishable products,) have to connect to the smart devices such as sensors, processors, antennas etc. However, the smart devices cannot embed to living objects automatically. Moreover, the production of farming is based on environment such as weather, soil, diseases and climate conditions like day light length, temperature, soil moisture, pests, etc.,. Furthermore, the farming products have to maintain in a specialized environments such as cold storage, hot cleaning, open air, fields, stables, etc. The production of healthy agricultural products is a typical task with many uncertainties and slow seasonal process, but consumers' demand is safe and fresh products. The main problem in smart farming is lack of financial, technical resources and sufficient skills for maintenance.

The application of smart farming is quite challenged, mainly due to high ambiguity of business progressions such as lack of integration, lack of experiments for development (Sundmaeker et. al., 2016; verdouw et. al., 2016). The production of agricultural is depending on livestock conditions and environmental situations such as weather, health, climate, and diseases. Therefore, existed technologies in agricultural production are still fragmented in order to integrated with new technologies and provide more solutions to the experimental developments. Existing applications for smart farming are focused on small group, but still focus at high ends on basic functions. A large

scale digital technology for farming is prevented due to lack of interoperability, data ownership, privacy and security.

### III. PROPOSED SYSTEM

#### 1. Cattle Crop Marketing Monitoring (CCMM) System

The automated IoT monitoring systems are very efficient to monitor the cattle, crop and marketing conditions. CCMM systems are significantly useful to make indulgent methods of IoT objects for monitoring. Live tracking and live identifying methods has been used to manage and monitor cattle, crop and market conditions efficiently. Therefore, these methods are prominent for deep analysis of the innovation of the mobile app to identify and manage the cattle, crop and market situations for the purpose of user alert. CCMM system consists of wireless sensor, integrated sensors, GPS and GSM broadband.

Pulse sensor is used to find cattle roaming places. The events can record by online web services for the collection of data. The farmers can get mobile alerts at the time of real-time threat on cattle through smart devices. The farmers are very particular in management or monitor the cattle effectively for the purpose of getting more productivity and profitability. Now a days farmers has been fed up with GPS machineries for instance auto steering tractors. Formerly, many machineries are similar type of processes has been followed. However, few standard processes included in the field monitor, group of cattle roaming and cattle feed. The Cattle system is helpful to farmer in order to monitor and control cattle effectively from any place.

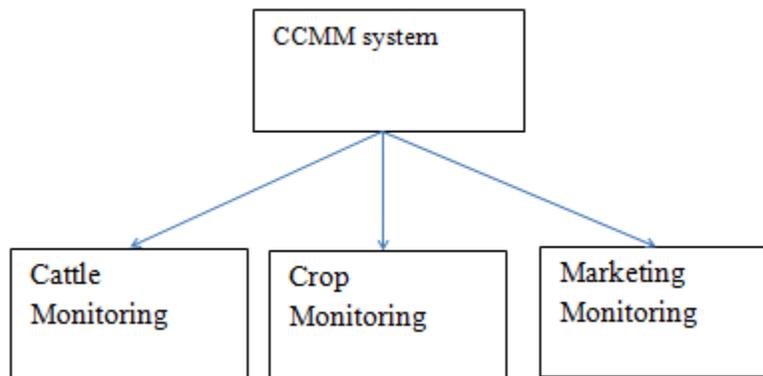


Figure 3: CCMM System Components

CCMM system monitors the cattle; farm and marketing conditions of the crop based on the interpretations of various sensors such as cattle moving directions, cattle health, milking sessions, soil moisture, nutrients, UV, climate, demand for marketing goods in various places, requirement of the future production, and send various messages to agriculturist. Therefore, farmer can do the actions quickly, and proper utilization of resources can improve the productivity. Moreover, the quality and quantity will increase by effective monitoring by agriculturist in various conditions. CCMM system is based on plug and sense concept. Smart devices are used to collect the live information for different conditions and areas. The following requirements are used for CCMM system.

- INVENTO SIM800L with ESP32 Node MCU wireless communication module GSM, GPRS antenna SIM

card module.

- 170 pins mini breadboard
- DHT11 digital relative humidity & temperature sensor module
- FC 28 soil hygrometer
- UV index/IR visible light sensor
- Light emitting diode
- KY-006 passive buzzer
- 5V 2A power bank charger module
- Power supply module
- CRV Estroject
- Smart Ear, collar, halter tag sensors
- Cattle microchip implant
- Smart phone / Laptop / tab

## ***2. Cattle Monitoring System***

In this system cattle health is prominent to get better profits and reduce cattle illness. There are many ways to maintain cattle health: The connected sensors in cattle wearable allow the farmers to monitor pulse rate, heartbeat, blood pressure, temperature, digestion system and others conditions of cattle. The farmers can identify illness of cattle through the direct data streaming to cloud from wearable. The farmers can use IoT devices to monitor the reproductive process or calving process with safe and successful manner. IoT sensors are used to track cattle's locations such as feeding cattle location, sick cattle location, and so on. The following four services have been provided by the cattle system.

1. Cattle roaming movements
2. Productiveness of cattle
3. Cattle Performance
4. Secretion of milk

**Cattle roaming movements:** Automated tracking mechanism is used to monitor the cattle at any center point of roaming location. The GPS integrated by sensors have been used to identify the cattle roaming movements.

**Productiveness of cattle:** Cattle monitoring system is used to ensure the critical situations of cattle at the time of calving. It can detect health condition of cattle through the sensors and send the information to smart devices.

**Cattle performance:** The performance of cattle could be measuring by the activity of cattle such as eating activity, health problems and so on. After that the data can send to cloud, so that the farmers can get information through their smart devices.

**Secretion of Milk:** IoT sensors can identify the situation of cattle lactation allowing by cattle. Hence the milk production and milking sessions could increase. The cattle can equipped with transponders, which are used to track the readiness of cattle lactation. Growing the milk productivity can possible through alerts of sensors which are

fixed in wearable of cattle. Therefore the farmers could get alerts to extract the milk for specified livestock many times in a day with a tracking of milking speed. Moreover, track the food consumption of cattle to boost the productivity of milk. Infections, diseases and other health issues of cattle could be monitored. Therefore the farmer can prevent loss of curb.

### ***3. Crop Monitoring System***

Crop monitoring system is playing major role for production of food, so that the quality of product and productivity of crop could be increased. Crop monitoring system can help the farmers in order to control the costs and crop optimization. The following ways are used in this system to optimize the yields.

Data collection: in this way the quality of soil, weather conditions and moisture levels could be gather to prepare the effective and efficient harvesting.

Reduce crop damage: this could be possible through the forecasting of productivity and take appropriate measures to prevent the loss.

Crop growth conditions: monitor the climate conditions and behavior of pest predictions for the health of crop and also address the issues of crop.

Crop Irrigation: the requirements have to analyze for the availability of water sources and reduction of waste.

### ***4. Market Monitoring System***

Market monitoring system is used to improve the marketing conditions of the production by using smart devices. The productivity of cattle and crops could market faster with profitable manner. Market monitoring system mainly deals with the following

Check the yield of the crop in the current location: The farmers have to find the same crop probability in their locations, so they can have the idea about the cultivated crop. Therefore, the farmer will get information about the crop; if the cultivated crop yielding is less in nearby areas then the production is having more demand. Hence the agriculturist can sell their products with high cost.

Find the yield of the crop in various locations: In India, the yield of the crop probability is essential, because the agriculturist can distribute the crop to various areas where availability of the products is very less or nil.

Find the total yield of the crop: National wide what is the total production of the particular crop is useful to export other countries. If more than sufficient products have produced in that particular time, the farmer can get more income while exporting the products.

Based on the previous data, predict the requirement of the present crop: The requirement of production has to predict before the cultivation of specified crop. The farmer should know the requirement of the production, so the products which are high demand can produce by the farmer.

Check whether the yield is greater, lesser or equal to requirement: If the yield is greater than requirement as per prediction then the farmer is suggested to sell the crop and invest that amount in other activities for profit. If the yield is lesser than the requirement then the farmer is suggested to store the crop for higher profit. If the crop is

equal to the requirement then the farmer can take a decision to sell some crop and store some crop for profits.

### 5. Framework for CCMM System

CCMM system framework consists of three sub systems which are connected each other. These are sensors (Kaewmard, 2015), database (Li, 2019), communication (Wang, 2015; Dachyar, 2019) sub systems. The first sub system is interlinked with second sub system to collect process and manipulate the data. The third sub system is also interlinked with second sub system to communicate the farmers in order to give messages to their smart phone, smart computer or smart devices for visualization purpose. INVENTO SIM800L module has been used for the purpose of the message transfer and monitoring purposes. The proposed CCMM system is proficient of well execution and decision makings according to the manipulated data. The following Figure 4 shows the framework of CCMM system.

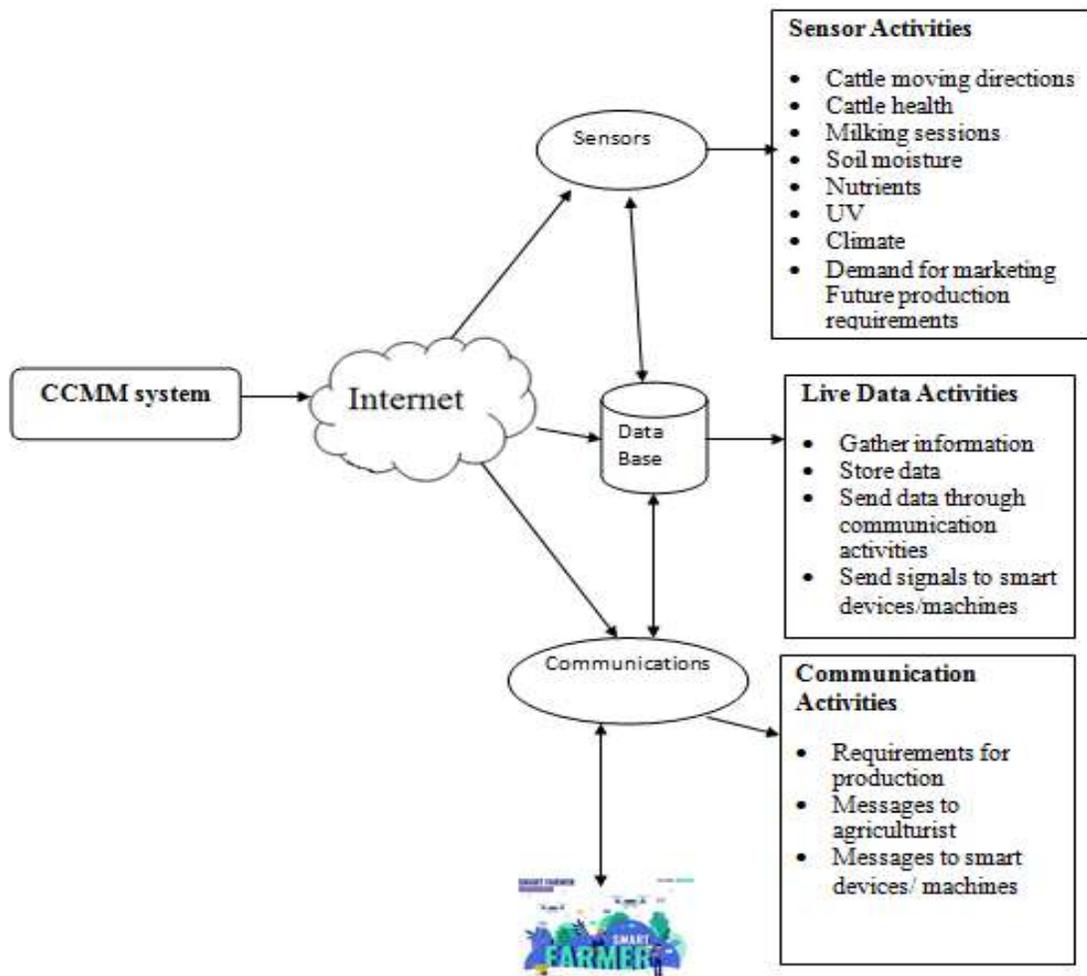


Figure 4: Framework for CCMM System

According to the field of cattle, crop the sensors has been positioned. Each sensor is connected with other desired sensors and gather information from the environment and process to the CCMM system which is equipped with 170 pts mini breadboard microcontroller. DTH 11 is used to detect the temperature and humidity of the field.

FC 28 soil hygrometer will detect the soil moisture of the field. Smart tag sensors will detect the livestock motion movements, LEDs used to monitor the growth and development of plants. When any uncertainties such as heavy rains, heavy winds, livestock trespassing etc., happened or any conditions occurred on field damage then Ky-006 passive buzzer can trigger the alarm (Elrawy 2018). 5V 2A power bank charger module and power supply module has been used to supply the electricity continuously to all the devices. Each sensor's information is transferred to the central database then compares threshold values for each sensor and send information to the farmers accordingly. If the data is crossing the threshold value then the user will get SMS through GSM module. The user can check or monitor the sensor's data of each sensor through web pages using smart devices such as smart mobile, smart PC's, laptops and tabs.

#### IV. CONCLUSION

The backbone of Indian economy is an agricultural sector and this sector facing lot of challenges or calamities or unsatisfactory conditions or crisis to produce and market the agricultural products at a profitable manner. The traditional or old farming methods do not satisfy demand of the exponential growth of Indian population. Hence digitalization of farming is required to reach the necessities of growing population. The present paper proposed CCMM system to facilitate the growth of production and economy by applying various technologies and sensors. The digital technology for farming described the detailed framework of the CCMM system along with functionalities. Moreover CCMM system focused on the benefits of digital farming. Nowadays one of the major research topics of the world is digital farming to increase the national income and GDP.

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