Smart Remote Internet of Things based Agriculture Model for INDIA

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Abstract— There are lots onsite Internet of Things (IoT) based Agriculture Model have been proposed and implemented in several countries especially technology developed countries like US, Japan and China etc. But the scenario of India is different in comparison to technologically developed countries to implement IoT model due to some barriers, which are as follows (1) Electronic and IoT devices cost is higher and unaffordable by Indian farmers. (2) Electricity is not available in every rural areas and agriculture fields of India which is a bitter truth. (3) Internet is very costly in compare to the income of maximum agricultural farmers of India. (4) Majority of farmer is illiterate, poor and not technology friendly; they couldn't operate smart phone, laptop and IoT devices till date. In the proposed model, Solar Panels based IoT (agricultural) embedded Drone with wireless internet connectivity has been filed over agriculture fields and collect data. It will be controlled and operated by government offices and NGO type organizations of Blocks. It eliminates all barriers to implement IoT in our Indian agriculture system. This model replaces onsite IoT model to remote IoT model as a intermediate solution with little variation of periodical data collection (i.e. less data produce periodically) but economically this model will be proven as a blessing especially for India. This model is developed especially for India and Indian states but it will also beneficial for other countries and states as well.

Key words: IoT, Internet of Things, Agriculture, Drone, Remote IoT, Cloud, Big Data Mining

I. INTRODUCTION

Internet Of Things (IoT[1])[5],[6] based agriculture model is better in comparison to conventional agriculture model due to its regular (huge data produce in short period i.e. per minute or per hour or per day) monitoring of agriculture field status like climate, environment, soil properties, crops status, temperature, Internet Of Things (IoT)[1] is the inter-networking of physical devices or connected devices or smart devices; embedded with electronics, software, sensors, actuators, and network connectivity (generally wireless) which enable these objects to collect and exchange data and information. Pressure, humidity and GPS location etc. via IoT devices in comparison to conventional human based irregular (less data in long period i.e. quarterly or half yearly or yearly) agricultural survey of agriculture fields. These data and information are very important for making better quality/production of crops by analysis, prediction and learning using data-mining2 [4],[8],[9] to make right decision and take action for hazard prevention. More data, information and knowledge give better forecasting and results.

There are several IoT based Agriculture Model[7],[12],[14] have been proposed and implemented in several countries specially technology developed countries like US, Japan and China, where electronics, server, computer and IoT devices with software are available in very low cost due to production of these devices in their own countries. They are using Onsite IoT based Agriculture Model which require large number of IoT devices to be installed in agriculture fields with network connectivity basically Internet, regular huge electricity/power consumption and larger cloud servers for "big data mining"3 [10],[11],[13],[15] (data-mining process shown in Fig. 3) because this system produce huge amount of data per day.

But the scenario is different for India to implement IoT in agriculture field because electronics, server, computer and IoT devices with software cost is very high since make in India production of these products with export quality is very lesser or almost nil. Therefore we have to import from technology developed countries which results into increase in cost of goods 3 to 1000 time4 due to currency exchange rate, transport.

Data mining is the computing process of discovering patterns in large data sets involving methods at the intersection of machine learning, statistics, and database systems [3].

Data is called "big data" if it is big in terms of volume. "big data mining" is data mining where data volume is very huge.

Note: As we know that production cost of electronics very less and software copying cost almost nil in comparison to selling price after good/technology developed and manufacturing firm established. Main cost occupies in research and development of product and manufacturing firm

Cost etc. Electricity is not available in every rural areas and agriculture fields of India which is a bitter truth. Internet is very costly in compare to the income of maximum agricultural farmers of India. Maximum farmers are illiterate, poor and not technology friendly; they couldn't operate smart phone, laptop and IoT till date. These things are the barriers to implement IoT in our Indian agriculture system.

In the proposed "Smart Remote Internet of Things (IoT) based Agriculture Model for INDIA" we are going to make intermediate solution to deal with the about problems.

In this paper we will discuss proposed method in section (II), experimental results and discussion in section (II) and conclusion in section (III).

II. PROPOSED METHOD

A. Proposed Model

In the proposed model we used IoT (as shown in Fig. 1) (agricultural) embedded Drone5with Solar Panels and wireless internet connectivity (as shown in Fig. 2) which will fly over agriculture fields and collect data. It will be controlled and operated by government offices and NGO

type organizations of Blocks. This model replaces onsite IoT model to remote IoT model with little variation of periodical data collection (i.e. less data produce periodically) but economically this model will be proven as a blessing especially for India.

Fig. 1: IoT Process Steps

Fig. 2: IoT (Agricultural) Embedded Drone with Solar Panels (Model)

Establishment, which recovered within 3years, if business strategy is good.

[5]An unmanned aerial vehicle (UAV), commonly known as a drone [3], is an aircraft without a human pilot aboard. UAVs are a component of an unmanned aircraft system (UAS); which include a UAV, a ground-based controller, and a system of communications between the two. The flight of UAVs may operate with various degrees of autonomy: either under remote control by a human operator or autonomously by onboard computers.

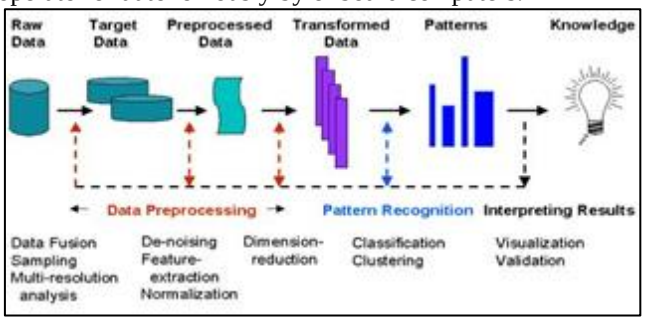

Fig. 3. Data Mining Process

1) Proposed Model Steps

a) Fly Drone

IoT (agricultural) embedded Drone with Solar Panels and wireless internet connectivity fly over agriculture fields. It will be controlled and operated by Block's govt. offices/headquarters and some NGO type organizations.

b) Collect agriculture fields' data using IoT (agricultural) sensors. Data may be climate, environment, soil properties, crops status, temperature, pressure, humidity and GPS location etc. Pre-processing, measurement and interpetion may be done here partically.

c) Save Data

Save data on Drone Memory (retrieve saved data after returning Drone to controller) and send to operator via wireless network from site.

d) Send to Cloud Server

Operator will be send retrieved data and information to the Central or Cloud server[9],[11],[12].

e) Analyze, Predict and Learn

In the server analysis, prediction and learning using data-mining processes have been done on the collected data and information.

f) Act & Optimize

On the basis of analysis, prediction and learning government, NGO, researchers and farmers can make right decision and take action for hazard prevention and produce better quality crops.

In existing IoT models step (a) doesn't involved and this makes the proposed "Smart Remote Internet of Things based Agriculture Model for INDIA" different from existing IoT models.

Note, this model is developed especially for India and Indian states but it will also beneficial for other countries and states as well; which are not technically developed plus technically developed countries and states as an alternative model to reduce IoT implementation cost on their agricultural fields with little variation of periodical data collection.

B. Merits of the Proposed Model

This IoT embedded Drone with solar panels will be work all things which an existing IoT and conventionally agriculture model does with the following enchantments to overcome from above mentioned problems of India (section I):

No large number of onsite IoT intallation required because small number of Drone will be fly over agriculture fields to collect data.

No electricity required because it will take energy from Solar Panel.

No or very little invol ment of far mers is requied because it will be controlled and operated by govt. offices and NGO type organizations of Blocks. Farmers have to only give coporation in collection of data and information by Drone without any intruption.

N o or very little need of farmers' finace is required because it will be controlled and operated by govt. offices and NGO type organizations of Blocks.

No need of Moblie connectivity is required all the time of data collection because it will be controlled and operated via Internet as well as wireless, internet, radio, Wifi and Mifi single. Collected data and information will be collected govt. offices and NGO type organizations of Blocks and send to the central or cloud server,[14],[16],[17].

It will collect daily to weekly dat a and infromation preiodically which is lower than exiting onsite IoT mode (regular huge data produce in short period i.e. per minute or per hour or per day) and very much higher than

conventional human based agricultural survey (irregular less data in long period i.e. per quarterly or per half year or per year) of agriculture fields, which is an intermediate solution.

No need of huge finance because small number of Drone will be fly over agriculture fields to collect data.

C. Limitations of the Proposed Model

Little drawbacks of the proposed model are as follows:

1) Drone can be intrupted by farmers, animals/birds, electric/telephone pole cables and on the loss of network connectivity with Drone which will be make phycial damage in Drone.
2) Drone's power capicity will be reduced in cloudy sky because Solar Panel would be produce lesser power in clouldy sky.
3) It will collect daily to weekly data and infromation preiodically which is lower than exiting onsite IoT mode (regular huge data produce in short period i.e. per minute or per hour or per day), which is an intermediate solution.

III. Experimental Results & Discussion

As we know that more data gives us more stable analysis and prediction result. Let us assume conventional human based survey is done quarterly in a year, existing onsite IoT based model collect data periodically in 1 hour and proposed remote IoT based model collect data periodically in 1 day; from each field with same kind of data (D) with same processes.

A. Number of Data Collect Periodically Per Year

- Conventional survey : 4 per year
- Proposed model : 365 per year
- Onsite IoT models : 8760 per year

B. Cost of Dat A Collection in One Year

- Conventional survey : INR. 4*X
- Proposed model : INR. 365*Y + Y1 + Y2
- Onsite IoT model : INR. 8760*Z + Z1 + Z2

Where,

- X = Conventional survey cost
- Y = Proposed model data collection cost Z = Onsite IoT model data collection cost
- Y1 + Y2 = one time drone cost + maintenance cost
- Z1 + Z2 = one time onsite IoT installation cost + maintenance cost
- Experimental results shows:
- INR. 8760*Z + Z1 + Z2 > INR. 365*Y + Y1 + Y2 ~ INR. 4*X

C. Benefit by Pr Oduction of Crops per Year

- Conventional survey : INR. M
- Proposed model : INR. M+M*N%
- Onsite IoT model : INR. M+M*O%

D. Experimental Results Shows Following Conclusions

Here, value of N and O is very higher in comparison to M i.e. Conventional survey gives poor result in comparison to Proposed model and Onsite IoT model, O is not very much differs from N i.e. Onsite IoT and model Proposed model gives benefit in production is not very much differs with very high difference in cost.

Finally, we found the proposed model gives better result in low cost.

IV. Conclusion

In the proposed model, IoT (agricultural) embedded Drone with Solar Panels and wireless internet connectivity will fly over agriculture fields and collect data and eliminates all barriers to implement IoT in our Indian agriculture system. (1) reduces number of electronic and agricultural IoT devices which will be controlled and opera-table by govt. offices and NGO type organizations without onsite installation of costly IoT devices which would be out of reach to the maximum Indian farmers since they can't afford right now, (2) solved the problem of electricity, which is not available in every rural areas and agriculture fields of India it is a bitter truth, (3) Internet is very costly in compare to the income of maxi mum agricultural farmers of India and (4) maximum farmers are illiterate, poor and not technology friendly; they couldn't operate smart phone, laptop and IoT till date. This model replaces onsite IoT model to remote IoT model with little variation of periodical data collection (i.e. less data produce periodically) but economically this model will be proven as a blessing especially for India.

Note, this model is developed especially for India and Indian states but it will also beneficial for other countries and states as well; which are not technically developed plus technically developed countries and states as an alternative model to reduce IoT implementation cost on their agricultural fields with little variation of periodical data collection.

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