Establishment of Internet of Things In Indian Agriculture Especially in Jharkhand State and Challenges

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Abstract- *Lot of Internet of Things (IoT) based Agriculture Model has been proposed and implemented in several countries especially technology developed countries. But the situation of India especially in Jharkhand state is different in comparison to technologically developed countries to implement IoT model due to some barriers and challenges. In this paper we have discussed barriers, challenges and some kind of solutions as alternative to establish IoT based agricultural system in India especially in Jharkhand. This paper will be also beneficial for other developing countries and states as well.*

Keywords- IoT, Internet of Things, challenges, agriculture, cloud, big data mining, India, Jharkhand.

I. INTRODUCTION

Internet Of Things (IoT) [2,3,4], [7] based agriculture system is more beneficial in comparison to conventional agriculture system since IoT sensors produces huge by regular monitoring of agricultural field status (such as climate, crops status, environment, humidity, temperature, pressure, soil properties, and GPS location etc.) in comparison to conventional human based irregular 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-mining to make right decision at right time and take action for hazard prevention. More data, information and knowledge give better forecasting and results. There are lots IoT based Agriculture Model have been proposed and implemented in several countries especially technology developed countries like US, Japan and China.

We have make different model for establishment and real implementation of IoT in India especially in Jharkhand state in agriculture fields because the situation of India especially in Jharkhand is different in comparison to technologically developed countries due our technical and financial status difference.

In this paper we are going to discuss about barriers and challenges in section (2) and an intermediate solution in section (3) as alternative to establish IoT based agricultural system in India especially in Jharkhand flowed by experimental results and discussion in section (4) and conclusion in section (5).

II. BARRIERS AND CHALLENGES

In technically developed countries 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 use onsite IoT based agriculture system which require large number of IoT devices to be installed in agriculture fields with network connectivity basically

Internet, huge regular power consumption and larger cloud [5,6,7,8,9] servers for “big data mining”1 [5,6], [10] (data-mining process shown in Fig. 3) because this system produce huge amount of data.

1) We have to pay 3 to 1000 time more for computer, electronics IoT devices and server with software since we have to import from technology developed countries which results into increase in cost of goods due to man power cost higher, currency exchange rate, transport cost etc.
2) Electricity is not available in every rural areas and agriculture fields of India especially in Jharkhand rural areas which is a bitter truth. IoT required 24x7 hour electricity.
3) Internet is very costly in compare to the income of maximum agricultural farmers of India.
4) Maximum farmers are illiterate, poor and not technology friendly; they couldn’t operate smart phone, laptop and IoT till date.
5) 1 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.

6) We have to depend upon other technology developed countries for cloud computing services, software and hardware devices, including IoT which is not good our country India in security aspects. Because other countries can trace and track your confidential information.

These things are the basic barriers and challenges to implement IoT in our Indian agriculture system especially in Jharkhand state.

III. PROPOSED METHOD

3.1 Proposed Model

We proposed model for dealing the above situation by using Solar Panels based IoT (as shown in Fig. 1) (agricultural) embedded unmanned aerial vehicle (UAV) with 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. 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. 2. Solar Panels based IoT (agricultural) embedded UAV (Model)

Fig. 1. IoT process steps

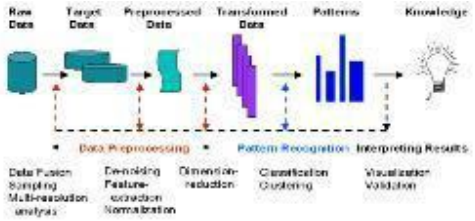

Fig. 3. Data mining process

3.2 Proposed Model Steps

a) Fly UAV: IoT (agricultural) embedded UAV with Solar Panels and wireless internet connectivity fly over agriculture fields. It will be controlled and operated by Block's govt. offices/head quarters 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 interpretation maybe done here partially.
c) Save data: Save data on UAV Memory (retrieve saved data after returning UAV 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.
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 and 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 onsite IoT models step (a) doesn't involved and this makes the proposed model 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.

3. 2 Merits of the proposed model

This IoT embedded UAV 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):

1) No large number of onsite IoT installation required because small number of UAV will be fly over agriculture fields to collect data.
2) No electricity required because it will take energy from Solar Panel.
3) No or very little involvement of farmers is required because it will be controlled and operated by govt. offices and NGO type organizations of Blocks. Farmers have to only give cooperation in collection of data and information by UAV without any interruption.
4) No or very little need of farmers' finance is required because it will be controlled and operated by govt. offices and NGO type organizations of Blocks.
5) No need of Mobile 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.
6) It will collect daily to weekly data and information periodically 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.
7) No need of huge finance because small number of UAV will be fly over agriculture fields to collect data.

3.3 Limitations of the proposed model

Little drawbacks of the proposed model are as follows:

1) UAV can be interrupted by farmers, animals/birds, electric/telephone pole cables and on the loss of network connectivity with UAV which will be make physical damage in UAV.
2) UAV's power capacity will be reduced in cloudy sky because Solar Panel would be produce lesser power in cloudy sky.
3) It will collect daily to weekly data and information periodically 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.

IV. EXPERIMENTAL RESULTS AND DISCUSSION

As we know that more data gives us more stable analysis and prediction result. In our experimental setup we assumed 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 with same processes. Experimental results shows that conventional survey gives poor result in comparison to Proposed model and Onsite IoT model, onsite exiting 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.

V. CONCLUSIONS

In this paper, we have discussed about our barriers and challenges to implement IoT our agriculture system, technical and financial status difference with technically developed countries. Finally, with the of above discussed situation we have proposed an intermediate solution i.e. IoT (agricultural) embedded UAV with Solar Panels and wireless internet connectivity will fly over agriculture fields and collect data and eliminates all previous discussed barriers and challenges to implement IoT in our Indian agriculture system. 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 and especially Jharkhand state. Note, this model is developed especially for India and Indian states especially Jharkhand agriculture system but it will also beneficial for other countries and states especially developing countries and states as a alternative model.

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