

IoT, Big Data Science & Analytics, Cloud Computing and Mobile App based Hybrid System for Smart Agriculture

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Abstract -Here we presents AgroTick, an innovative hybrid system for smart agriculture. AgroTick is an IoT based system supported with mobile interface and designed using technology modules like cloud computing, embedded firmware, hardware unit and big data analytics. AgroTick is architected and designed to improve the efficiency of agriculture, build a well-connected farming network and create a knowledge sharing platform for farmers. In a longer run, AgroTick will address two key issues plaguing agriculture in India – harvesting rainwater and groundwater, and predicting effective utilization of the same.

Keywords- *IoT (Internet of Things), Data Analytics, FPGA (Field Programmable Gate Array), Android, GPS (Global Positioning System)*

1. INTRODUCTION

Internet of Things (IoT) is an inter-disciplinary field that has lately emerged as one of the key domains of research in the high tech industry as well as the academic arena. As a concept, IoT is a paradigm that considers pervasive presence in the environment of a variety of things as well as objects that through wireless and wired connections along with unique communication protocols are able to form an interactive ecosystem. This eco-system further cooperate with other similar framework to create new applications as well as services and reach common goals in that process. In this context the research and development challenges to create what is now called *a smarter world* are enormous. A world where real, digital and virtual components are converging to create cognizant environments that impart hitherto unseen intelligence into urban and rural entities including cities, villages, transportation media, homes and agriculture.

The broad goal of the Internet of Things is to enable objects to be connected anytime, anyplace, with anything and anyone ideally using any route and any communication service. Internet of Things, a new revolution of the Internet, is built around solutions coming from fields like computer science, electrical & electronics engineering, communication engineering, software technology, medical science and many other areas, and is not a single technology. Rather, IoT is a concept in which things of different characteristics get seamlessly connected and appropriately enabled. These connected systems create a plethora of new business opportunities and add to the complexity of IT.

IoT is quickly becoming one of the hottest technological domains in India. According to a recently released TechSci Research report, “India Internet of Things (IoT) Market Opportunities and Forecast, 2020”, IoT market in

India is projected to grow at a CAGR more than 28% during 2015 – 2020. Growth in the market is anticipated on account of ongoing technological developments in IoT technology for providing better connectivity and coverage as well as real-time monitoring & tracking of services and systems across diverse industry verticals to reduce operational and manpower costs. Moreover, large scale government projects such as smart cities, smart transportation, smart grids, etc., are also expected to further propel the use of IoT technology in the country over next five years.

Agriculture is one of the key growth areas of IoT in India. the dawn of human civilization, agriculture has been a crucial part of every human society due to the basic fact that the sustenance of any civilization directly depends on agriculture. India, in particular, is an agriculture heavy economy. Surprisingly, agriculture has not been blessed with the latest advancements in the high tech space unlike other areas like communication, transportation, education, finance etc. Advancements in agriculture are necessary to balance the demand and supply as the population is increasing day by day. With the use of modern and advanced technologies, efficiency of the agricultural industry can be dramatically improved [6]. We strongly felt the need for introducing modern technologies in agriculture to replace traditional, inefficient and time consuming farming practices. This thought eventually led to the conceptualization, design and development of *AgroTick*.

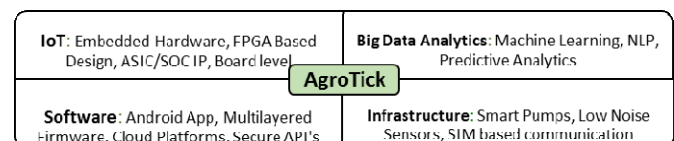


Figure 1: *AgroTick* Eco System

2. CURRENT LANDSCAPE

In spite of being one of the most critical aspects of our civilization, agriculture has not been appropriately blessed by recent advancements of Electronics, Computers and IT unlike many other domains that impact lifestyle. However, the situation is changing at a rapid pace. India is currently going through a transition phase from the agricultural standpoint. In the recent Union budget, Indian government gave a push to market reforms in agriculture to improve the economic condition in rural India. These proposed agricultural reforms are expected to come from three seemingly unconnected domains that often get interconnected in the context of

farming, especially in recent times: Bio technology, Nanotechnology and Information & Communication Technology (ICT) [3]. The summation of these three distinct technological aspects lead to the ideology of smart agriculture. In order to make the market more accessible to the farmers, the concept of e-farming has been introduced [4]. E-farming is the web application that will help the farmers perform the agro-marketing leading to achieve success and increase in their standard of living [1]. In compliance with smart technologies, robotics is also being introduced so as to make more room for technological advancements in agriculture. Internet of Things (IoT), an emerging inter disciplinary domain, is also contributing in smart agriculture [2] and a combination of IoT, Cloud Computing, Big Data Analytics and Mobile Technology has got the potential to dramatically change the domain of agriculture and redefine the way farming is being perceived.

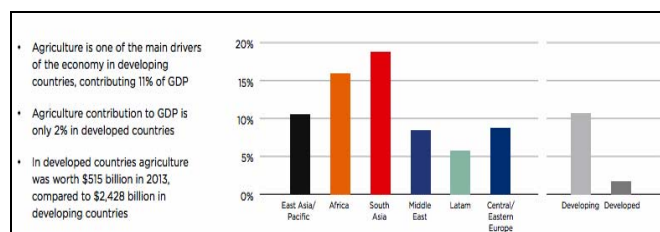


Figure 2.0: Agriculture, value added (%-age of GDP), developing economies only, 2013

3. *AgroTick* : An IoT, Big Data Analytics, Cloud Computing and Mobile Applications based Hybrid Solution for Smart Agriculture

Smart agriculture is a multi-dimensional combination of a number of different technological implementations. These applications are replacing inefficient, inconsistent and unreliable traditional farming techniques with efficient, reliable and sustainable smart agriculture. Some examples of these paradigm shift include context aware farming, contract farming, pesticide control, remote monitoring, security control, environmental monitoring, precious agriculture, machine and process control, etc. In the world of cognitive science, any system, process and domain is said to be smart if follows 6 different levels of intelligence: Adapting, Sensing, Inferring, Learning, Anticipating and Self-organizing. Jotting all these 6 initials, we can define smart agriculture as a combination of the following three paradigms: Smart Consumer, Smart Farmer, Smart farms. *AgroTick*, a mobile based end to end IoT solution for Smart Agriculture works at different levels including, adaptive water control through WSN, Numerical optimization through data science and efficient communication through Cloud Computing.

The Government of India's recent focus on all business through Aadhar has opened up this sector for data driven work. Aadhar linked agricultural information network can be easily conceptualized using mobile communication and big data analytics operating on geo-spatial data already available with Ministry of agriculture, ISRO, Survey of India to optimize resource availability, spread and distribution. Cloud computing based agronomy through in-app cashless transactions for agricultural products is next set of possibilities. The user friendly, feature rich and scalable mobile App and SAAS of *AgroTick* are the central cockpit

for resource optimization, profit maximization, information sharing and agricultural consultation as well as training [5].

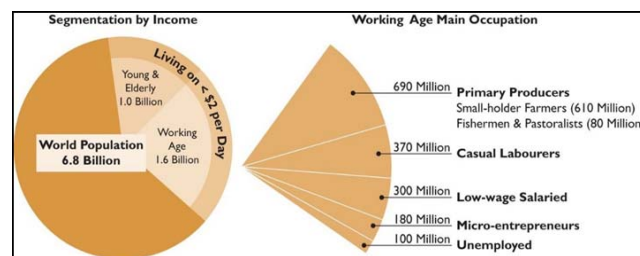


Figure 3: Total available market size for Smart Agriculture

AgroTick will also be available in different regional languages for a wider outreach. Currently we are working with STEP (Science and Technology Entrepreneurship Program, Govt. of India) to promote this product. *AgroTick* will create new opportunities in agriculture including easy agro loan, inexpensive agricultural consultation, better ROI, agro networking, low cost products etc. This product can open new research directions for farming optimization.

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