E-Services Based Contextual Smart Agro System using IoT

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This Report Presented in Partial Fulfillment of the Requirements for the Degree of Master of Computer Science and Engineering

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MAY 2021

APPROVAL

This Project titled "**E-Services Based Contextual Smart Agro System using IoT**", submitted by Md. Waliullah Rahat to the Department of Computer Science and Engineering, Daffodil International University, has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of M.Sc. in Computer Science and Engineering (MSc) and approved as to its style and contents.

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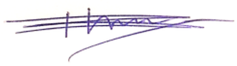

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We hereby declare that this project base thesis has been done by us under the supervision of **Mr. Abdus Sattar, Assistant Professor of CSE Department,** and Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

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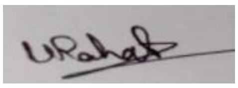

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ACKNOWLEDGEMENT

First, I express my heartiest thanks and gratefulness to almighty God for His divine blessing makes me possible to complete the M.Sc. thesis successfully.

I really grateful and wish my profound my indebtedness to Mr. Abdus Sattar, Assistant Professor, Department of CSE, Daffodil International University, Dhaka. Deep Knowledge & keen interest of my supervisor in the field of "**E-Services Contextual Smart Agro System using IoT**" to carry out this thesis. His endless patience, scholarly guidance, continual encouragement, constant and energetic supervision, constructive criticism, valuable advice, reading many inferior drafts and correcting them at all stage have made it possible to complete this thesis.

I would like to express my heartiest gratitude to **Dr. Touhid Bhuiyan, Professor and Head,** Department of CSE, for his kind help to finish my thesis and also to other faculty member and the staff of CSE department of Daffodil International University.

I would like to thank my entire course mate in Daffodil International University, who took part in this discuss while completing the course work.

Finally, I must acknowledge with due respect the constant support and patients of my parents.

ABSTRACT

An E-Services based Smart Agro system with IoT proposed in this study. The conceptual framework follows four different layers which optimize the IoT infrastructure in order to receive e-services based on the e-services base contextual information. And the ICTization process aims to expand the ICT technology development function. Such views of the system minimize the misperception of technology, growth and connectivity and strengthen the coordination of raw data, management and services. The expected roadmap facilities omnipresent farm treatment services supported by the coordination of five entities, namely farmers, agricultural officers, network operators and farmers. IOT and smart, automated food production. Environmental control is the major factor in increasing productive crop yields, and the new system guarantees that facilities are available everywhere, at any time without any barriers.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Bangladesh is a nation based on agriculture and it is still Bangladesh's most vital area, 19.6% overall national Output Comes from agriculture and 63% of the population are directly involved. Bangladesh has 61.2% of arable land as per the World Bank (previously in 1980was 68.3%) [1]. Growth rate of the population usually decreasing the arable land. Rice, jute, and tea are the main crops and for decades agricultural exports have dominated by these crops, although most of the grown rice is use for domestic consumption, the major export payers are jute as well as tea. Sugarcane, tobacco, cotton and different fruits and vegetables (sweet potatoes, bananas, pineapples, etc.) are also grown by farmers for the domestic market. But there is crisis in water, the accessible fresh water is further polluted by the population of humans and animals and also the population increased at an unprecedented rate. A capable and smart farming system that can help farmers make sensible use of the water level and also address other discrepancies, such as unrequited entry of animals into the fields. Microcontroller and measurements such as pressure, temperature, moisture content, and motion are existing in the system, but not restricted to them alone. For connectivity between sensors, microcontroller and network, the system uses wireless connections.

A mobile application is also a part of the model which one allows the client for managing watering power. In this article, the Smart Agriculture Project will use the idea of Internet of things, cloud computing and Wireless sensor network for helping farmers to schedule their farm's watering schedule via an agricultural profile that can be updated according to their needs. An algorithmic watering system is formed depending on feedback from the user to maximize use of water for farm field. Proposed system will have a decentralized Wireless communication put in the plant's root zone for moisture and temperature of soil.

A gateway unit also controls sensor data, activates sensors, and data is moved to a web service. An algorithm is built with limit values for temperature and soil moisture that were coded into a microcontroller-based gateway to measure water quantities. Proper irrigation and fertilization planning are of great importance for proper crop growth. The multiple factors influencing the amount of water crops need under specific Environmental standards are:

- Moistness
- Sunlight
- Velocity of wind
- Passive detector for infrared
- Seed surveillance
- Heat

The field-based climate data collected and surmised together with web weather data directories are used for make a few efficient decisions to increase cultivation. If warm, dried, hot and humid, windy, high amounts of water are required for crops and if such variables are like frigid, humid, foggy, low wind, so less water is required for the crop.

This proposed model is based on the context-conscious conceptual framework and ICTization process method, which expands the ICT infrastructure promotion initiative. From a business perspective, this work would assist produce a model to Categorization an accurate range for Infrastructure of information communication technology components in order to achieve a precise tactical positioning. But at opposite side, this study will provide a holistic structure aimed at achieving higher production levels and healthier crops. Possible use of IoT in agriculture is about empowering farmers with decision-making tools and automation technology that seamlessly combine products information and services to improve productivity, performance, and benefit.

1.2 Motivation

Now a times Bangladeshi farmers are facing many challenges, while agriculture role for humanity grows ever more vital. The impact of climate change are becoming more and more clear and growers are struggling the most-it is estimated that just by 2050, food production would decline by 18%. Rapid population growth increase food demand while at the same time, due to urbanization, arable landscapes are decreasing. This is the high time to protect the supply of fresh water, especially considering that 60% of this increasingly limited resource is consumed by farming. Furthermore, there is strong competition among growers to reduce and distinguish costs. Throughout this circumstance and all of these reasons have led us to develop a smart agriculture system for farmers and agriculture industry of Bangladesh.

1.3 Research Objectives

We have outlined some research Objectives below and can be explained by our suggested assumptions mentioned in the remaining parts work -

- A functional and structured guidance must be developed over the preset ICT framework for context-based smart farming systems.
- There should be no boundaries surrounding the system; users can receive services anywhere, anytime.
- The platform must be accessible; consumers should be free to access and use the resources without interruption.
- Defining and separating the positions of different entities or stakeholders in the proposed model.
- The template should be able to achieve a level of satisfaction by delivering rapid assistance and services.

1.4 Report Layout

This report divided into 5 chapter. Chapter 2 shows background. Methodology is described in chapter 3. Chapter 4 shows implementation and section 5included the conclusion.

CHAPTER 2

BACKGROUND

2.1 Related Works

Agricultural study is being improved in many ways to improving the quality and volume of the productivity of agricultural products. Scientists were there Concentrate in soil characteristics, various weather factors as well as scouting crops on many different projects. The important factors for making a useful and acceptable IOT network for farmers are low-cost and low-power. In this [2] paper discusses a smart agriculture model with minimal-cost, minimal-power IoT network to monitor soil moisture using in house developed sensor which use less power and have an average lifetime of 83% at a lower cost. In the age of globalization climate change and Inconsistent rainfall of the last decade lead the farmers to adopt many methods of smart agriculture. In this [3] paper proposed remote monitoring system where the system Is collecting farm data in real time combining the internet and wireless communication which will provide Easier access to Agricultural services such as short massage warnings (SMS) weather advice, crops, etc. Farmers are focusing on smart agriculture as global population growth and declining cultivation land.

In the paper [4] discuss many advantages and challenges using IoT and Data analytics for better agriculture production. How IoT incorporates many systems already in use and how IoT and information mining are used to boost the agricultural sector's operational efficiency. Now the Internet is no longer limited between PC and mobile. The idea of Internet of Things is connecting so many devices to the Internet and the machines can communicate between themselves and now, the data available from the machine is no longer kept on the private server and is online, the user can access it anytime easily.

In this [5] paper they propose to develop a sensor node that can simultaneously detect temperature, soil moisture and humidity around plants, light intensity and take time-consuming action based on this data. In this [6] paper a roadmap for accurate farming is presented in IoT technology research and innovation and IoT-based productivity communication and detection of methods appear to minimize difficulties in the field of accurate farming is discussed. IoT and smart farming with automation. Environmental monitoring is one of the key factors in improving efficient crop yields.

In this [7] paper smart farming network which utilizes benefits from the forefront technology like mirco-controller, Internet of things and WSN. Using Wi-Fi/3G/4 G Developed system capable of monitoring the temperature level, humidity level, moisture value and even entry of animals capable of destroying crops in agricultural fields using Arduino board sensors and sending SMS notification. In this [8] paper a Long distance, IOT self-propelled system for correct use, presenting prototype designs and tests, is agricultural and aquatic. They used microcontroller RF52840 with support for Bluetooth 5 and environmental energy harvesting. Proposed prototype using a coded transmission, a sighting range of up to 1.8 km is achieved and it could be extended by adding devices in multi-hop network topology.

In this [9] paper they proposed an IoT based smart agriculture system which can collect data about soil characteristics, soil Ph, soil moisture, temperature, weather, and light. The system is able measure, analyze to take time-consuming action based on this data for precision agriculture. In this [10] paper proposed system Active monitoring of agricultural parameters and greenhouse cultivation control system. The process aims at regulating CO2, temperature, soil humidity, and light dependent on soil moisture, for the greenhouse windows / doors the control action is accomplished on a quarterly basis, dependent on crops. Observational data based on sophisticated agricultural telemetry technologies from an Internet of Things (IoT) platform and how the Big Data Processing Concept and Decentralized cloud operations should meet the demand for agricultural IoT applications and How smart farming can help farmers to operate more efficiently and safely are discussed in this [11] paper.

In this [12] paper a smart agriculture model is proposed where a poly house is made of steel structured covered by poly and some sensor like water level sensor, soil ph temperature sensor, sensor, motion detection sensor is included. Data from the sensor are store in webserver and user can easily access from their smart phone.

CHAPTER 3
RESEARCH METHODOLOGY

3.1 Framework Model

This framework's main responsibilities are examining and decide the intelligent activities of these smart devices by establishing a diverse connectivity between them. The new architecture would help optimize IoT technology as it can provide service based on background data that keeps the current infrastructure untouched. The effective cooperation of these disparate devices and procedures can lead to future environmental computing that will ensure maximum use of cloud computing.

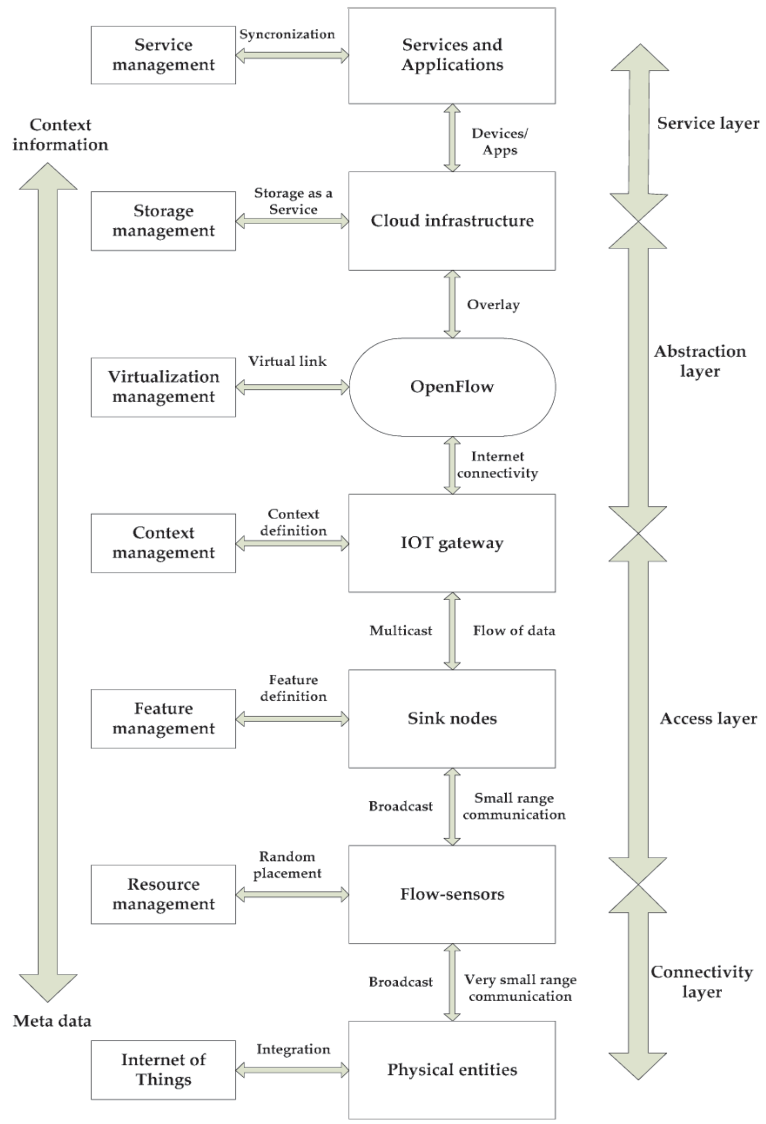

Figure 1. Background of the conceptual framework

3.2 Background of the Conceptual Framework

We intend to divide the overall network system. In figure. 1 four-layer system for the collection of context-based raw data e-services from the Internet of Things are shown. Such four layers build a general framework that will not change the existing network architecture but creates a network virtualization interface between services and entities.

1) Connectivity layer

All physical devices included in this layer are associated with each other's structure and connectivity. The future of the Internet is largely dependent on integrating these common issues available anywhere, close to us and individually identifiable and controllable. This category often involves networking equipment with short range such as sensors actuators, RFID tags, etc. and Inventory management analyses the physical allocative efficiency of all underlying infrastructure devices and networks. There are very limited resources for these tools, and with a slight overhead, the resources ensure maximum use. It enables information to be shared and transmitted within a single network through multiple networks or various domains. It is possible to use RFID tags as illustration of communication devices are very short and small to fit anywhere. It can draw power from the solar that solves the requirement for battery or external power supply. In order to reach the IoT gateway, Sensor combines a wide range of RFID tags with a short range of smart devices for multi-hop data transmission.

2) Access layer

Raw data captured from short range devices will send to internet using IoT gateway. This layer is responsible for defining the topology, initiating the network, creating the domain. Access layer also involves communication configuration, intra-inter domain interaction, planning, flow-sensor and IoT gateway packet transmission. Feature control requires a user filter that only recognizes suitable background information and excludes redundant data. A large number of sensors have many facilities, from these facilities only few features are useful in generating context data. The interface filter minimize redundant data sharing, raises the speed of useful data processing, and also reduces energy and Processor costs. Based on the program specifications and the form of information in scope, the number of features that vary. Context Management manages a server that stores data from the DB controller and the sync node, tests data values and thresholds values, and performs operations. Several standard values are originally allocated (also known as marginal values), and then the currently agreed values (data value) are included. Only changed values are retained in the server where duplicates are not allowed. Only modified values are stored in the database if duplicates are not allowed.

3) Abstraction layer

Any of Open Floor's most important features is to connect the digital layer with preset layers while retaining the framework that has been built. The network is simply a core

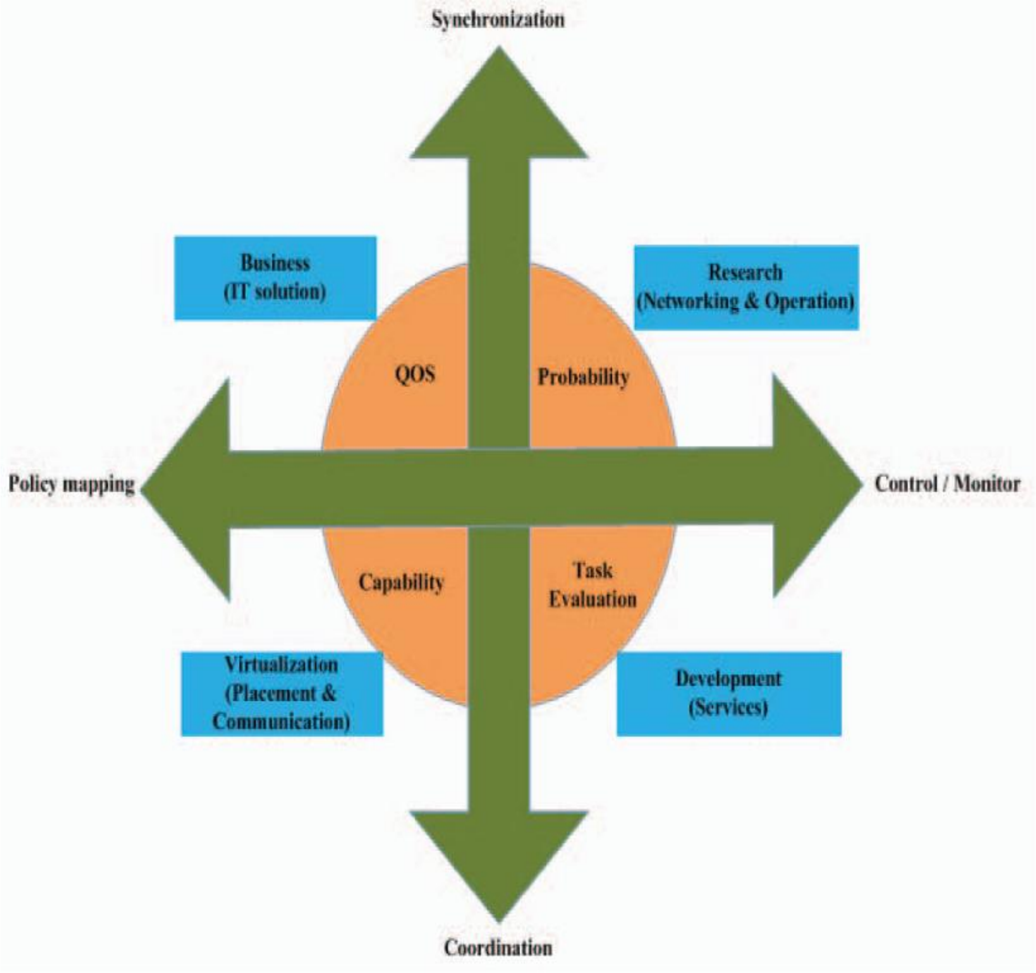

Figure 2.ICTization Framework

device from the physical point of view, but it is possible to maintain a service delivery (flow visors can be used). A centralized system can monitor and control traffic of all kinds. This might enhance the bandwidth, robustness, mapping, etc., leading to good service (QoS). Packets are distributed through certain neighboring nodes in the multi-hop view. Thus, in a flow view, the nodes near the access point carry a greater burden than the distant nodes, and these important nodes ' inactivation network may collapse. Digital existence of nodes of sensors can solve problems where through access point discussions between two sensor networks with a virtual links.

4) Service layer

Storage management consists of all forms of unknown and/or necessary information and technology to make the model flexible, effective. Not only is it responsible for data storage, it is responsible too for ensuring privacy. It requires easy access to data. Integrates data based on the resources provided to optimize business intelligence analyzes and, most importantly, enhances processing capacity.

Cloud computing infrastructure can benefit from all business, especially from the small business perspective, while full IT problems for large IT problems can be solved. This will contribute to the advantages of businesses, their staff, customers and suppliers where it is possible to provide general business solutions. These incoming services need to be interconnected and integrated to fulfill the needs of socioeconomic factors such as Environmental assessment, measurements of safety, weather strategic planning, modernization of agriculture etc. The projected context can be diagrammed by simplifying conscious smart agriculture services. Because of the management of diversity, the framework provides for the launch of a computing. Most notably, it will also keep up and running the existing network and cloud technology.

3.3 Framework for ICTization

A full structure that can be nationally accentuated by ICT strategies and influencing variables for global harmonization to form a complete ICT must be effective. The structural section of the layers will lessen the uncertainty improving service, progress and messaging, integration between management and services. The full application of our proposed level designing approach is conscious and Service-based that adopts intelligent service beyond the projected model. This framework is simplified into 3 tier service-based frameworks, such as the distribution layer, the management layer, and the root level of the fig. 2 and figs. 3. Such three rates provide a common interface between scheduled and received services. Definitions of operation and improvements are finalized at the level of distribution, part of the decision support, authentication management level, and analysis of captured data are completed at the core level.

Below are the functionalities of each layer:

1) Distribution layer

The topmost layer which will help the context this is the description used to determine the difference and name of an entity's site and state that originates in our environment. Information such as identity, locality, location, etc. is important for interaction between user and service. This level carries the great potential of distributing novel services, sharing resources and developing the quality of services on IOT network. It involves positioning virtualization for better communication, network analysis and procedures, and it can offer better companies with a complete IT solution. A flexible system can be modified to create meaning automatically by operation attitude transition and role switch status. It is important to note that our proposed smart agro system is among of the online services and effective at this level; the information is transmitted in the context shape where the position and individuality of the user will be assessed.

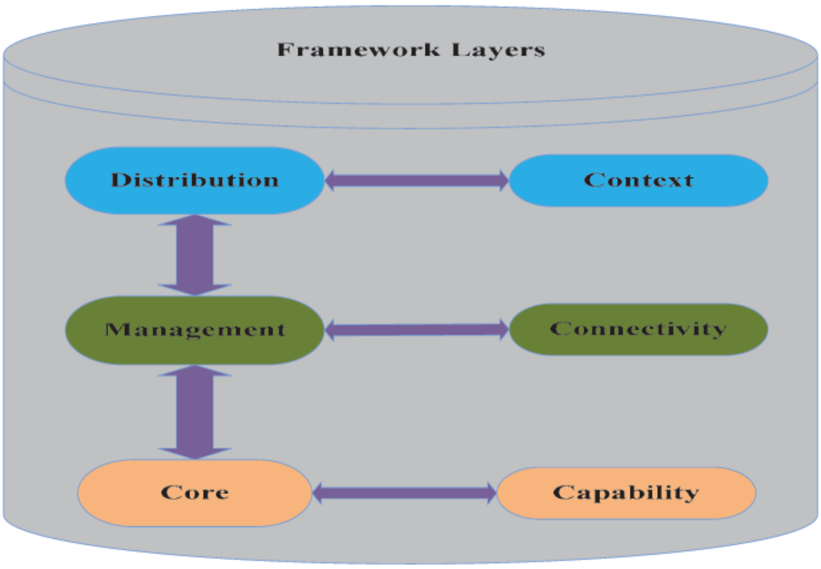

Figure 3. Framework layer for ICTization

2) Management layer

The concept of the ability to reach the level of connection management or the availability of the desired service. It also includes coordination between a number of services for cost, power, time savings and more from the viewpoint of resources and consumers. Various types of business strategies can be assisted by association or collaboration; the expense and flexibility of small business approaches where over-IT problems of large companies can be solved. It will provide advantages for corporations, their staff, customers, distributors, etc. This tier involves management of space and network, rule analysis, scheduling and operation planning. It combines essential services and logistical solutions and becomes convenient as a result of new user interface creation. These incoming services have been forced to integrate and integrate to meet the demand for Socio-economic issues like climate assessment, calculation of security, climate control, agricultural modernization, etc.

3) Core layer

The responsibility of core layer is decision making and evaluation at the bottom level. This level is able to measure the probability of a given task, including the probability of error. This layer carries the idea to align the raw and vital technology and data that can make the structure scalable and efficient. It is not only responsible for gathering information, but also for providing privacy along with. This effectively prohibits data retrieval; Attaches information to developing the service continuity, data analysis depends on essential services and, most importantly, promotes efficiency in space.

CHAPTER 4

CONTEXTUAL SMART AGRO SYSTEM

4.1 Contextual Smart Agro System Implementation

Projected system has 7 entities they are Environment, IOT, IOT Gateway, internet service provider, application server, service application, and user are drew in fig. 5 and fig. 6. These entities ' brief functionalities are as follows:-

- Environment means the crops field which are integrated with IOT devices and can use the IOT gateway to send the data collected by the sensor.
- The IOT gateway is responsible for sending the data to application server and also send emergency notification about crops field; both action required to connect IOT gateway to internet service provider through 3g/4g.
- The Internet service provider connects to mobile devices and monitors the uniqueness of subscribers.
- The application server are responsible for store, process and analyze the data and handling request from the user. User can easily access the desired data from application server using the service application.

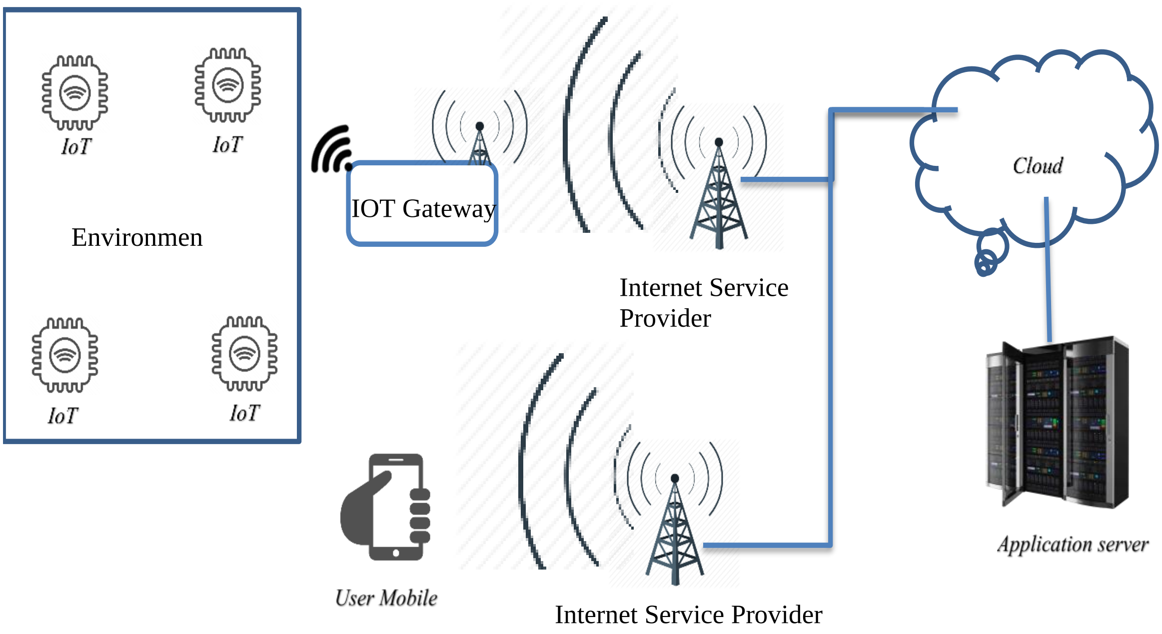

Figure 4. Network Architecture

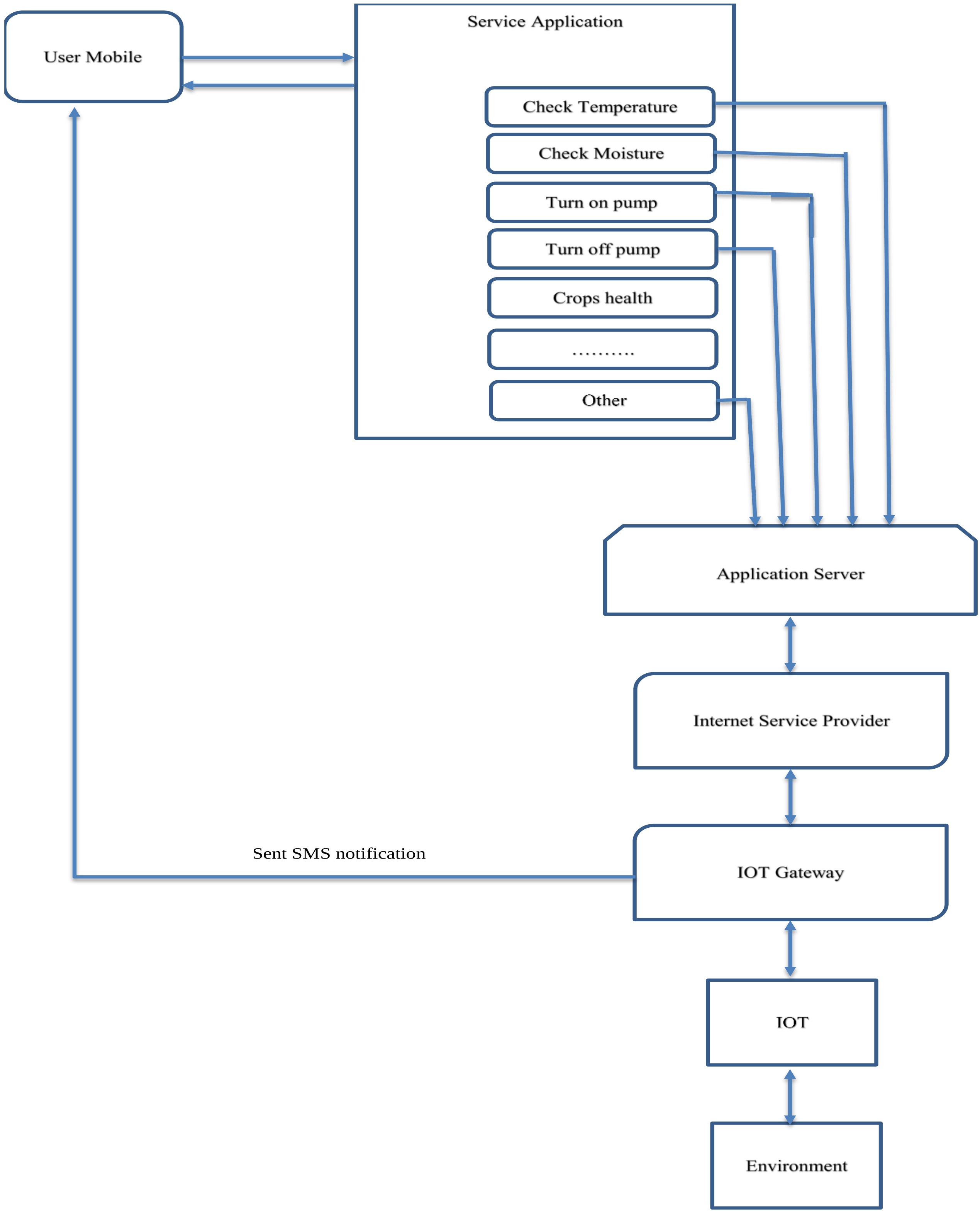

Figure 5. Smart agro System Architecture

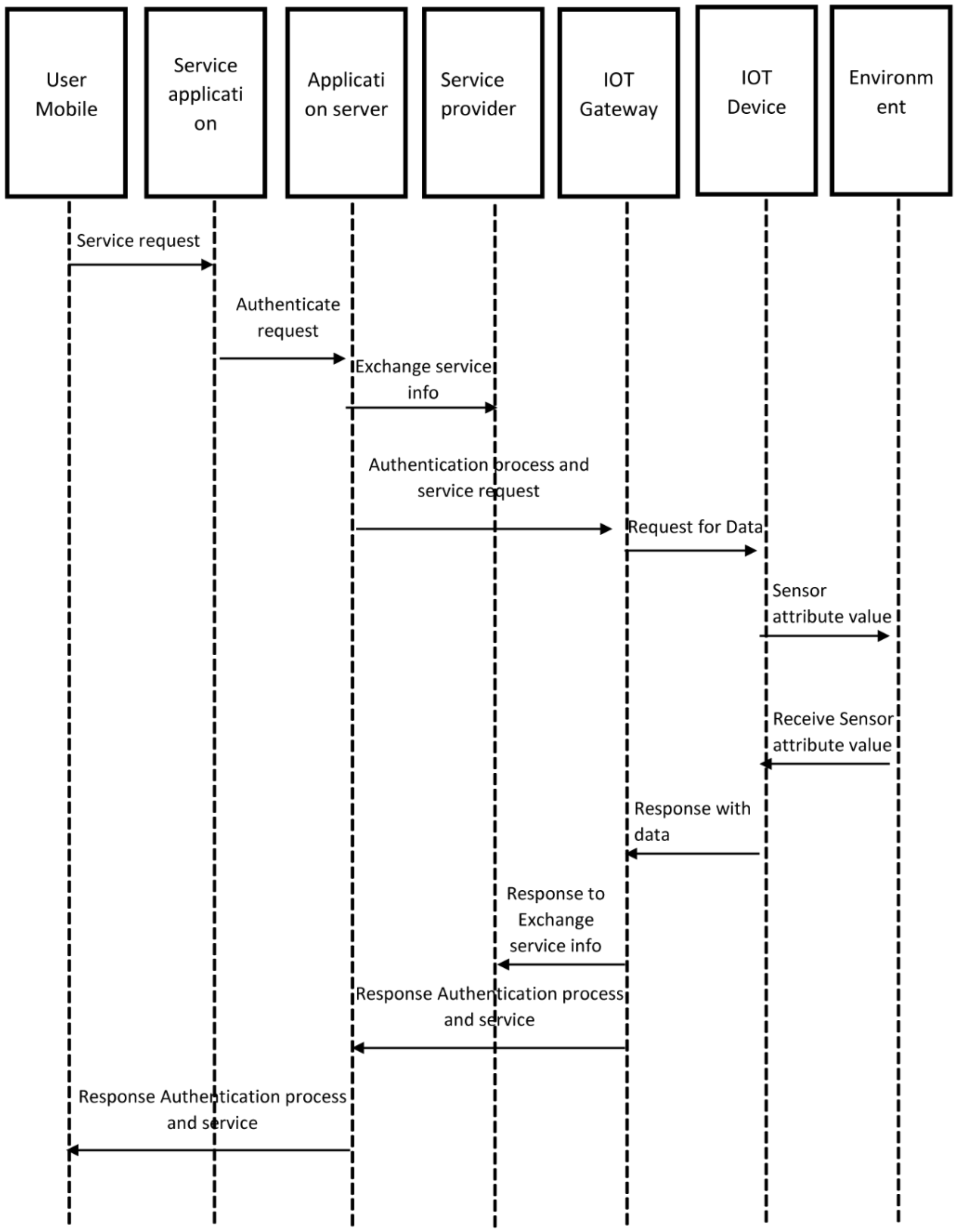

Figure 6. Operations of Smart agro System

- The application server will work as an interpreter by transforming user interaction to application server. The application is responsible for notify the user and provide desired information request by user.
- Farmer and Agriculture officer are the user who will get the information about crops health. Farmer can take necessary action based on the received information. On the other hand an agriculture officer will collect summary information from database about the field.

For example a farmer want to know moisture of his field soil then he will open the service application and click on the option named check moisture then application will get the current moisture reading from application server. On the other side IOT device are frequently sending the sensor reading data and application server will process the row data and send to service application. If any unwanted animal inter the crops field then motion sensor will detect the unwanted entry and send a warning SMS using IOT gateway after that farmer will take immediate action protect the field from unwanted animal.

Anyway the smart agro system always maintain a communication with both user and the crops field.

CHAPTER 5

CONCLUSION

5.1 Summary of the Study

In addition to the raw data accepted by the physical device, the suggested framework supported by the context can manage the e-services IoT infrastructure. The conceptual aspect of this template is to coordinate, query and control the function of the individual entity. Many sensors that are stored in the cloud with an IoT gateway can be grouped and sent to their information context servers. And management tasks combined with multiple levels help to obtain contextual information from the raw data in the area. It template can be used for deploying a peripheral device to logical sections, different domains, creating virtual network connections and multiple applications without any centralized mechanism of coordination. Contextual understanding may play an important responsibility in making e-services and technology wider as it makes the perception of various meanings arising from surrounding space. Clear IoT isolation and precise value will assist various manufacturers and system vendors in completing their work and development on a large scale.

5.2 Conclusions

Innovation and new knowledge are necessary to allow an integrated and comprehensive approach to technology in precision farming. Agriculture can be made more efficient and reliable with the use of IoT devices. IoT can be used in different agricultural fields. Agriculture is most significant area of in Bangladesh. Farmer are losing interest from farming. Smart agriculture can increase interest to farming. Where farmer can easily maintain their farming using smart phone.

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