Increase Kitchen Garden Productivity using IOT and Virtuino app

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Abstract— *Continuously increasing food prices of basic kitchen items, fruits and vegetables the poor and fixed income groups are suffering from the decreasing real incomes and purchasing power. The marginal increase in the income of the poor people to enable them to gain access to food and improve their nutrition is the need of the present time. The kitchen garden falls under bio-intensive and participatory innovation which can provide year round availability, access and consumption of adequate amount and varieties which supply not only the calorific demands but also the micronutrients by the resource poor. One of the easiest ways of ensuring access to a healthy diet that contains adequate macro- and micronutrients is to produce many different kinds of foods in the home garden. This is especially important in rural areas where people have limited income-earning opportunities and poor access to markets. Kitchen gardening contributes to household food security by providing direct access to food that can be harvested, prepared and fed to family members, often on a daily basis. Kitchen gardens can be grown in the empty space available at the backyard of the house or a group of women can come together, identify a common place or land and grow desired vegetables, fruits, cereals etc that can benefit the women and community as a whole. This leads to give the idea of automated kitchen gardening system. The system is designed to sense soil moisture and amount of light falling on the plants. When the moisture content in the soil is too low, the system will give command to start a pump and water the soil. Apart from this the Arduino and ESP8266 it will transmit information on moisture level and ambient light. You can monitor all the data from your smart phone by using Virtuino app. Then a twit can be send to your account automatically if the moisture falls below a given threshold value. It provides full control and monitoring of variables such as temperature, pest management and control works and more.*

Keywords— Vegetables, kitchen garden, urban areas, Arduino and ESP8266.

I. INTRODUCTION

In Euthopia and world over high population growth, rural urban migration and vulgarities of weather have pushed the cost of food upwards (Silvia, 2012). The increased use of food crops in biodiesel production put further imbalance to food supply which further affects the demand/supply relationship. Non-communicable diseases add further pressure to the citizens and more so to low income groups. The resultant of this is more people are going to be food insecure. Famine Early Warning system warned that there will be a rise from 2.2 million to 2.4 million food insecure people in August 2012 (UN, 2012).

The answer to increased food demand cannot be met by the green revolution as well as rain fed agriculture which is already showing fatigue (Pastakia, 2011) This food insecure group needs to face the *c*urrent environmental and health challenges by identifying ways to better align aesthetics, ecology, and health (Denver Urban Gardens, 2012). A kitchen garden can be a part of the solution to this problem. As already proven one-size-fits all solutions cannot be applied in every area to answer the question of food sustainability (Beddington, 2011).

The higher demand for food should be met by practical innovations like kitchen gardening which not only improves availability but also answers the question of diversity required for a healthy community. The kitchen gardens can be viewed as an adaptive strategy of communities as an entry point for development. The kitchen garden can also help to reduce the gap of productivity between the technical potential and actual production levels of food crops due to low use of suboptimal inputs and low adoption of most productive technologies (Tittonell, 2012). A kitchen garden involves the very people who are the greatest resource for development in a view to improve their own livelihoods and empowerment as envisaged in the rural university concept (Mathai, 1985). The kitchen gardening is a radical transformation towards using resources more efficiently. The kitchen garden is perhaps the only available ecological space available to the poor to meet their economic needs especially so in Africa where the poor tends to rely more on natural resource base for their livelihood. Kitchen Gardens depend on the gardeners for maintenance and are spaces made meaningful by the actions of people during the course of their every-day lives. They are spaces where the gains from social capital, physical and symbolic arrangement of items of private

living space are aggregated and given utility value. Above all, Kitchen garden is an avenue where the actor is totally immersed in his role (Kimber, 2012).

The British and the Americans won two world wars by growing their own food to feed their armies and the people left at home (Great Britain Ministry of Food, 1946). Euthopians can feed themselves by growing what we eat and one way to do this is adopting the Kitchen garden. The kitchen garden is a form of Community adaptive strategies that leads to sustainable livelihoods (Agobia, 1999).

A kitchen garden is an integrated system which comprises the family house, a recreational area and a garden producing a variety of foods including vegetables, fruits and medicinal plants for home consumption or sale. The kitchen gardens have been found to play an important role in improving food security for the resource poor rural households in developing country like Bangladesh (Asaduzzaman, 2011) and can do the same in Euthopia.

II. WHY IOT

Internet of Things (IoT) is a broad term that describes the interconnection of different daily life objects through the internet. In the concept of IoT every object is connected with each other through a unique identifier so that it can transfer data over the network without a human to the human interaction [1, 8]. IoT has referred as a network of everyday objects having ubiquitous computing. The ubiquity of the objects has increased by integrating every object with embedded system for interaction [9]. It connects human and devices through a highly distributed network. Due to enormous growth in technologies, farming has become more popular and significant. Different tools and techniques are available for development of farming. According to the UN Food and Agriculture Organization, in order to feed the growing population of the Earth, the world will need to produce 70% more food in 2050 than it did now. To meet this demand, farmers and agricultural companies are turning to the Internet of Things for analytics and greater production capabilities. Internet of Things (IoT) can play big role in increasing productivity, obtaining huge global market, idea about recent trends of crops. IoT is a network of interconnected devices which can transfer data efficiently without human involvement.

Today many agricultural industries turned to adopt IoT technology for smart farming to enhance efficiency, productivity, global market and other features such as minimum human intervention, time and cost etc. The advancement in the technology ensures that the sensors are getting smaller, sophisticated and more economic. The networks are also easily accessible globally so that smart farming can be achieved with full pledge. Focusing on encouraging innovation in agriculture, smart farming is the answer to the problems that this industry is currently facing. All this can be done using smart phones and IoT devices. Farmer can get any required data or information as well can monitor his agricultural sector.

In Internet of things, we can represent things with natural way just like normal human being, like sensor, like car driver etc. This thing is assigned an ip address so that it can transfer data over a network. As per the report generated by Garner, at the end of 2016 there will be 30% rise in count of connected devices as compared to 2015. He further says that, this count will increase to 26 billion by 2020[10]. The IoT technology is more efficient due to following reasons: 1. Global Connectivity through any devices. 2. Minimum human efforts 3. Faster Access 4. Time Efficiency 5. Efficient Communication.

The proposed system can be used for.

1. Garden water management
2. Pest management and control works

2.1 Garden water management

- Usually the we pumps the water more or less to cultivate the land.
- This may result in wastage of water or insufficiency to the garden.
- To prevent such situation INTERNET OF THINGS has a system that sends an alerting message to the owner when the moisture level increases or decreases.

2.2 Pest management and control works

- Often our hard work is destroyed by predators (pests) that results in huge loss to us.
- To prevent such situation INTERNET OF THINGS has a system that detects the motion of predators using PIR sensors.

- This information can be used by the owner to reduce damage done by predators.

III. IOT BASED GARDENING

Technological innovation in farming is nothing new. Handheld tools were the standards hundreds of years ago, and then the Industrial Revolution brought about the cotton gin. The 1800s brought about grain elevators, chemical fertilizers, and the first gas-powered tractor. Fast forward to the late 1900s, when farmers start using satellites to plan their work.

The IoT is set to push the future of farming to the next level. Here in the field section, various sensors are deployed in the field like temperature sensor, moisture sensor and PIR sensor. The data collected from these sensors are connected to the microcontroller through ESP8266.

In control section, the received data is verified with the threshold values. If the data exceeds the threshold value the buzzer is switched ON and the LED starts to blink. This alarm is sent as a message to the farmer and automatically the power is switched OFF after sensing. The values are generated in the thing speak web page and the farmer gets the detailed description of the values.

In manual mode, the user has to switch ON and OFF the microcontroller by pressing the button in the Android Application developed. This is done with the help of Virtuino app.

In automatic mode, the microcontroller gets switched ON and OFF automatically if the value exceeds the threshold point. Soon after the microcontroller is started, automatically an alert must be sent to the user. This is achieved by sending a message to the user through the Virtuino app.

Other parameters like the temperature, humidity, moisture and the PIR sensors shows the threshold value and the water level sensor is used just to indicate the level of water inside a tank or the water resource.

The hardware is interfaced with all the sensors in the board. The hardware components include the microcontroller, relay, ADC converter, Virtuino app and all the sensors interfaced.

IV. ARCHITECTURE OF THE SYSTEM

4.1 Soil Moisture Sensor

A sensor that will sense the moisture level in the land (sand) called SOIL MOISTURE SENSOR.

4.2 Passive Infrared Sensor (PIR)

A PIR based motion detector is used to sense movement of people, animals or other objects

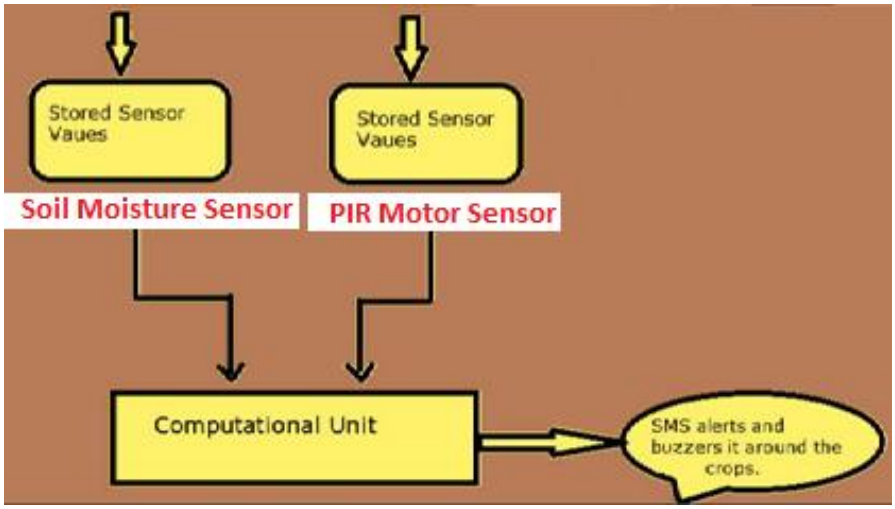

FIGURE 1: NODE1

Both SOIL MOISTURE SENSOR and PIR SENSOR are connected to the Arduino to perform an action. Arduino will send the data to the Thing speak server using wi-fi. If emergency it also send message and Alarm to the user by using Virtuino app.

V. EXPERIMENTATION AND RESULTS

As shown in figure 5, The sensors and microcontrollers of all Nodes are successfully interfaced with microcontroller and wireless communication is achieved between various Nodes.

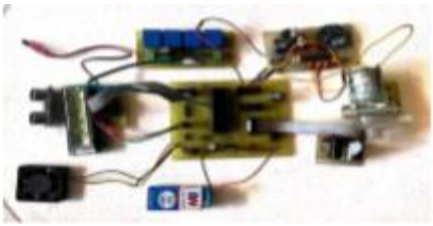

FIGURE 2: EXPERIMENTAL SETUP FOR NODE1

This is a complete solution to monitor garden activities and irrigation problems using sensors and microcontrollers respectively. Implementation of such a system in the garden can definitely help to improve the yield of the garden products and overall production.

VI. CONCLUSION

The sensors and microcontrollers of all Nodes are successfully interfaced with microcontroller and wireless communication is achieved between various Nodes.

All observations and experimental tests proves that propose project is a complete solution to kitchen garden /field activities, irrigation problems and pest management and control works respectively. Implementation of such a system in the kitchen garden can definitely help to improve the yield of the garden products and overall production.

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