

Empower Internet of Things using Intel Edison for Tech Homes

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ABSTRACT

In today's world automation in technology is rapidly enhancing. A person prefers to automate their daily life tasks to reduce energy and time. For the purpose of reducing daily efforts and serving more luxury in human's life home intelligence scheme based on Internet of Things has been developed. The system regulates electrical gadgets inside a home or a building with minimum usage of internet connectivity. It rules the essential appliances inside the home as per persons demand beyond human endeavor. It helps to minimize manual tasks of human and eliminates constantly taken physical efforts. The prospective of this system is to evolve a Tech Home with the help of Intel Edison board. The Intel Edison board will serve an efficient control over electrical home appliances with minimum power requirement and real time access support from any place in the world.

Keywords: Intel Edison, Internet of Things, Home Computerization, Web Integration, Android Device

I. INTRODUCTION

Now a day anybody can have an access of connectivity for different things over the internet from anyplace on real time basis. These networks of connection will enhance and form absolutely altogether leading and effective grid for Internet of Things [1]. In modern world, domestic habitant is empowered with improved web set up with digitalization. The computerization allows impressive and advanced platform to grow the network of connected things inside the structure to achieve goal of automation. The home intelligence system invokes local environment to reform condition of regular living with the arrangement of adaptable, robust, cozy and secure climate in daily life [2]. In today's world the crucial concern for humans is time management. In the highly occupied life sometimes a person forgets to switch off electrical appliances while leaving the building. In such scenario it evolves demand for automation of things to gain benefits from up gradation in technology. A regulatory command can be sent by a person to the central control of building to switch the state of appliance [3]. The researcher tries to find new things to satisfy people by providing innovative technologies but the process is still infinite. The home intelligence application in this system consists of Intel Edison board as a heart of the system to which numerous sensors can be interfaced. The objective of Tech Home is to integrate all the crucial home appliances and utility work, network of communication and information technology within a single brilliant web structure. The whole structure will then be operated, supervised and handled by the person.

The paper provides a view with an innovative approach to make the Tech Home which is a manifestation regarding framing and mapping of remotely composed multifunction structure that will alters a state of several ordinary electric gadgets by using Intel Edison. The Intel Edison board is set up for controlling the system within the structure consisting of typical house hold appliances and permits a user to have an associated data on smart phone device. The designed architecture will cater a response illustrating the present situation inside home about the sensor data; current mode of operation which has been selected for the Tech Home operation and also related to appliances is in working state or interrupted.

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II. RELATED WORK

To enhance the regular life aspects, to bring amenity and to implement home intelligence system, Internet of Things establishes unique and immense evolution [1]. Internet of Things specifies a structure which explains that ordinary gadgets used in usual life such as smart devices like phones, tablets, wearable gadgets, sensors and switching mechanisms using actuators are uniquely and smartly networked together. The elements are assembled in numerous means to interact among various people or objects, and among themselves to serve mutual connectivity. Internet of Things technology gives a potential to produce large number of innovative applications depending on computing elements, relays, sensors, etc. The system inside Internet of Things caters a channel to ordinary objects including provision of communication network, applications based on web, cloud computing, etc. It also brings a facility to gadgets to connect with each other, receive data, communication on web, content or information storage and restore it on demand, with user's facility to connect at any time or constantly. Internet of Things has an each thing with matchless identification code and the things are networked with each other inside the current internet infrastructure. Networked based schemes are more prominent mechanisms in worldwide retail market [2]. The biggest inspiration in persistence of improvement in technology is to enhance standard of living. Smart Home structures possess a mechanism which has a central control and all functions remotely. There are priorities set for the members of the house having different wishes and requirements over the entire home or particular modules or equipments [4]. The home automation systems have obtained global diligence because of their robust integration in daily routine life. By means of expanding demand of Internet of Things, it encourages distinct benefits in the area of smart cities, medical science, connected car, and Tech Home structures. Automation combines information technology and control systems in manufacturing of materials and services with minimal or no human intervention. An upgrade to machinery is to achieve autonomy for the Iron Age. Automation drastically decreases or eliminates partial or complete human presence for controlling machines as compared to aiding human strength with elements combined to perform a particular task on machines [5]. The system computerisation can be made using many wire free approaches such as GSM for worldwide usage, for particular area coverage Bluetooth, Zigbee or Wi-Fi can be used. The application would be excellent if it is having an ability to control gadgets from anywhere in the world. GSM based systems are the most suitable one but currently internet facility is easily available so it is not a barrier in recent environment [6]. Applying automated system inside the home, one can diminish the usage of human efforts, wealth utilization and time duration to accomplish daily routine tasks. Further the user can regulate and rule the gadgets inside the home. Building automation is a great and impressive evolution for office and home architecture. Many devices are there which provides control using speech regulation or using remote device [7]. Home Intelligence scheme serves huge exploration in research field by means of expanding modern technology in various areas of computing, manufacturing and construction. The values implied from sensor, notifies the person to take an applicable operation on device state, whether to switch ON or OFF the appliance [8].

The establishment of smart home scheme has a concern of managing household gadgets by means of internet. The facet of automated scheme into any architecture is obscure while considering area, particularly signal degrade over a longer distance. Today, in the world of advanced technology, it becomes easier to construct an application based on wire free technology which can access things in synchronization and with stable performance. The mobile phones allows user to hook up with an internet beyond the use of computer, providing same service with other aid. Along with the improved embedded things, mobile devices became impressive gadget and became crucial element of human's routine activity. Because of extensive usage of Android phones, it is chosen for user interface for remote access [9]. Android devices have covered around quarter part of mobile phone market as it provides economic and user friendly environment. Apart from traditional manner, people wishes to operate the functions of appliances using their mobile phones [10]. The unique and impressive demand to boost network of things inside a building to get the objective of

computerization lasts broadly unexploited. The total assembly of the system is incorporated with lower expenditure of component peripherals, which are readily available and hence lowers overall cost. The easy distribution is because of wire free transmission approach [11].

III. PROPOSED SYSTEM FOR INTERNET OF THINGS BASED TECH HOME

Internet usage has got a swift expansion in terms of its availability and total customers. The tools used in industrial manufacturing and daily life tasks should be able to send data and finish a work when person is occupied in another work, Internet of things serves this facility [12]. In this paper we have specified internet protocol defining wire free communication architecture for regulation of Tech Homes efficiently. Using relevant software and hardware consolidation Tech home is developed. The system described in the paper illustrates linked operation of Tech Home gadgets, with detailed system work flow and system assembly. Tech home structures definitely deliver a great experience to people. It can incorporate various environmental anticipated data and operates discrete devices inside home by backing of effective sensor grid acquiring relay. The most essential part of Tech Home is the system used for controlling functionality. The communication medium and proper networking is the components of Tech Home system entirely desire it. In the implementation, Tech Home is divided into two environments, Auto mode and a Manual mode. The system includes three different elements comprises with sensing mechanism, Intel Edison as a computing unit and an internet connection as a communication media. A person can connect to the web network to supervise the home accessories in real time scenario. The person can further use a smart phone device which includes an Android application to communicate with electronics inside the home. Among the improvement of civilization, many new electronic instruments have been included in an ordinary house. It appears a complication in supervising and controlling these numerous individual gadgets readily and effortlessly to obtain more convenient, lively and secure environment at home. Many applications are developed to get notified for theft or robbery and to control sensors or appliances based on GSM based facility using mobile devices. To reduce the usage of energy consumption there is a need to control the appliances remotely [13]. In this paper, a Tech Home development utilizing Internet of Things technology is been proposed to deal with the raised issue.

We have constructed a structure which is adequate to operate with nominal guidance by human. Even though Tech Homes are achieving great demand because of their benefits related to improved living aid and energy conservation, it doesn't have any typical standard design for Tech Home architecture. Backbone of communication as a wireless framework in a Tech Home is sensible preference for vital level for integration. The computerization can be fully automated one or semi automated and supervises the electrically connected home appliances. The computerization systems for home can also be separated into two groups. The structure which is locally operated is the one and other one is the structure operated remotely. For locally operated structure, the computerization is achieved by using computing mechanism within house and the person can use a wired or wireless connectivity medium for access. In the structures operated remotely, internet network inside the home is used upon integration, allowing a person to operate the structure from gadgets like computer machine, tablets, or smart phones from the security provider of home. The Tech Home consists of computing board as an Intel Edison, which is a fundamental unit of the architecture. Various sensors like Light Dependent Resistor sensor, proximity Infra Red sensor, soil humidity sensor and temperature sensor are interfaced with the Intel Edison board. The sensor elements will posts information to the computing unit which will further delivers it to Android smart phone or web page.

Figure 1 illustrates primary blocks of Tech Home system architecture. All sensors work as an input parameters to the controller and relay board acts as an output device to take the action. Controller is having wire free connectivity medium which is inbuilt inside the Intel Edison board. The architecture operates in two methods. One is Auto mode and second is Manual mode. For both the mode of operation a person is able to receive the needed data remotely on Android phone as a notification on smart phone application.

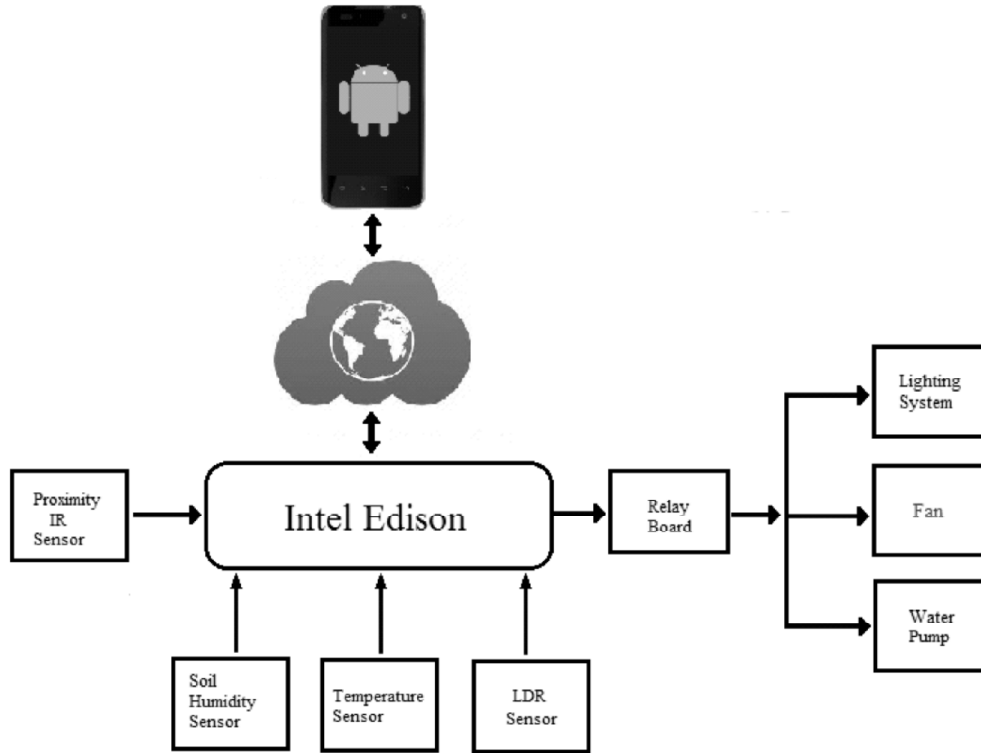


Figure 1: Proposed System for Internet of Things based Tech Home

Inside the notification a person receives the data regarding present condition of home appliance and after sending the command changed status of appliance. Considering Auto mode of operation, switching mechanism of home appliances will work automatically. The action will get conducted depending upon the data set on Intel Edison board previously. The information collected from sensors will be compared with previously set values and then decision will be made on state of gadget. The person will be notified with action conducted on the appliance state without any physical action. The LDR sensor will detect amount of light intensity, if sufficient light is not present; room lights will get switched ON and in case of presence of sufficient amount of light the room lights will get switched OFF. This technique is used to automate the lighting system for energy saving mechanism. The proximity Infra Red sensor is used to detect human presence inside a home to switch for Auto mode on demand. The soil humidity sensor will monitor moisture of soil if soil gets dry it will turns water feeding mechanism ON and after feeding sufficient water and observing sensors value the water feeding mechanism will be controlled and turned OFF automatically. This mechanism is commonly useful when person is not there in home. The LM35 sensor measures an environmental temperature; if the temperature increased beyond certain value then fan will get turn ON. Whereas as the temperature decreases below particular value the fan will automatically gets switched OFF. While in Manual operation mode, a person is able to take suitable action to change the state of appliance from ON to OFF or vice versa. All the electrical appliances are switched with the help of a single pole single through type of relay board. The information collected on real time basis from sensor components can be analyzed and processed to have statistics for future reference or survey purpose.

IV. ALGORITHM FOR INTERNET OF THINGS BASED TECH HOME SYSTEM

4.1. Steps for algorithm –

1. Start
2. Get Static IP Address for internet connectivity to an Intel Edison board

3. Using IP Address establish an internet connection
4. Check if the connection is established successfully
5. After successful connection establishment read data from sensors connected to the Intel Edison board
6. Send the sensor's data on a Web Server
7. Select a mode of operation – Auto Mode or Manual Mode
8. If Auto mode is selected go to step 9 or otherwise go to step 11
9. User will get notification regarding the action taken on home appliances
10. Go to step 5
11. Read current state of home appliances
12. Send a command to ON or OFF the home appliance
13. Check if the command sent successfully
14. Change the state of home appliance based on command received
15. Go to step 5

4.2. Algorithm description

At the start on power up, Intel Edison based system attempts to connect to local Wi-Fi network. Once the connection is established, an IP address can be obtained which is assigned to the Intel Edison board. An Android device should be connected to an internet before start of operation. Write the IP address on App which is developed for Android device and connect the phone with Intel Edison board. The board has started reading sensor data. On the App there is an option for mode selection either Auto Mode or Manual Mode. If Auto Mode is selected, system works automatically that is without intervention of user. User is only notified about all the actions taken inside the home. In Manual Mode, the system first reads the current state of appliances connected. The results are displayed on App. User then manually operate all the appliances using mobile phone. When a command is sent, it is verified before changing state of the appliance. If the command is successfully sent, the state change is reflected on appliance as well as on the App. The system then again gathers data from sensors and then further waits for receiving new commands. The system can be operated using computer also and same steps can be followed on desktop App. Web browser can be used to check the internet connection with the Intel Edison board whether it is established successfully or not. The flexibility is provided to the user for switching system operation between Auto Mode and Manual Mode at any stage during operation. Once the system is powered ON it will work continuously in infinite mode.

V. RESULT AND DISCUSSION

Figure 2 (a) shows hardware assembly consists of Intel Edison board and other required circuitry. Components are assembled on one single board which is connected to the Intel Edison board. The aim of developing a single board with other components is to provide flexibility to users so that one can add or remove the components easily as per need. Figure 2 (b) shows the mobile App on Android phone. It is developed to give options to choose which device is going to be operated through users command from mobile phone. In above setup fan is operated using Manual Mode and notification has been received as an alert on phone regarding current status inside home.

The Tech Home control architecture is feasible, balanced and functional which is implemented practically and tested for experimental results. The result characterizes Intel Edison board and represents its possible

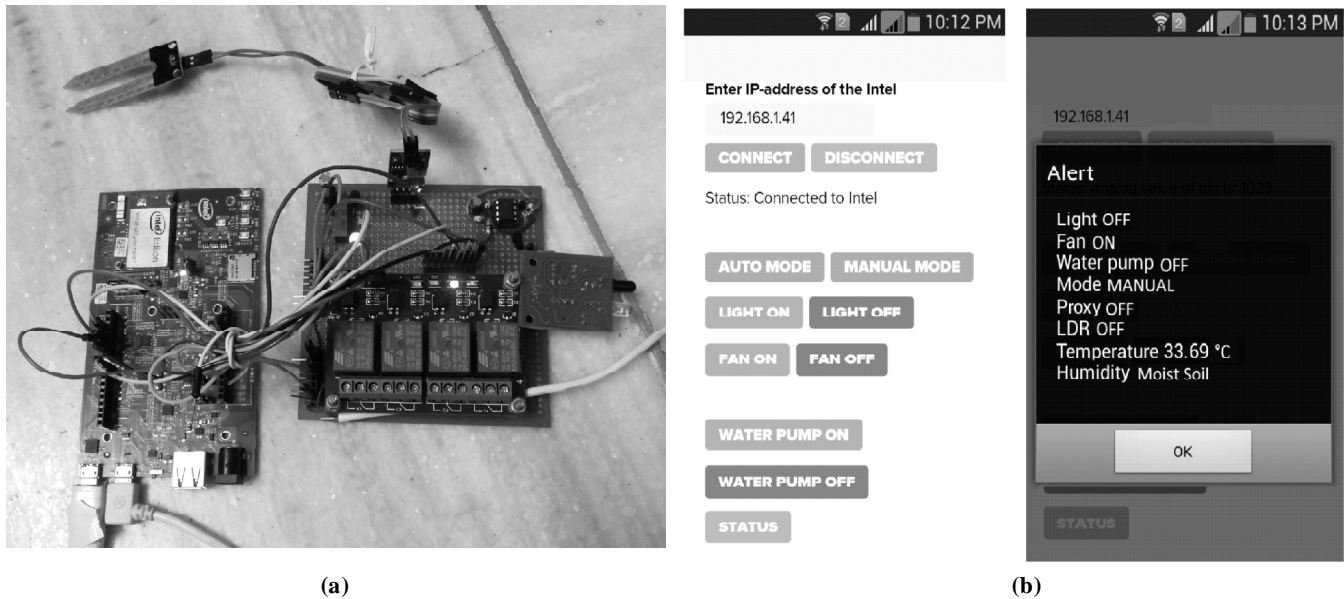


Figure 2: (a) Tech Home Hardware Implementation (b) Android Application running on Smart phone to operate Tech Home

deployment in environment of Tech Home. In this context, Intel Edison board is raising computing board and is able to serve such demand. The great prominence is central control based on Intel Edison which has inbuilt Wi-Fi connectivity and other wireless connectivity features with least power consumption among latest computing devices. Computerization is needed as human beings can forget to switch off electrical gadgets or it can be remained ON by mistake and causes accidents when no one is in home or building. In such scenario there is also a case of energy utilization. To elder persons and handicapped people mobile phone notifies and helps providing control operations easily. In this effort we have developed and assembled an entire functioning structure using a computing controller board. A person can also use smart phone device while travelling worldwide.

VI. Conclusion and Future Work

We conclude the accomplished effort brings a crucial aspect for achieving Tech Home structure. The Tech Homes produces life extra luxurious, more intact and more adequate by associating network of operational subsystems with one to another. Related to traditional house, Tech Home serves numerous facilities, particularly the structure developed in this effort. As the system is having basic layer for control as a sensor network, an electrical appliance can be added or can be removed from the central control unit very efficiently. The intelligent central control unit embraces many activities like supervision of appliance, management and regulation, security of house, data analysis regarding energy.

This paper illustrates peculiar structure for robust and cost effective home supervising and controlling system by the means of Android smart phone device. Several smart phones having Android operating system and having built in Wi-Fi support can be utilized to operate the gadgets inside the home. If connectivity of Wi-Fi is not accessible, then a cellular mobile data 2G, 3G or 4G can be accessed to operate Tech Home.

The implemented work can be grown further to form smart town. Numerous sensors and different concepts can be incorporated for smarter lifestyle development. The remote information can be collected for individual parameter in the system and evaluated by authorized person having access for information for security issue avoidance. The huge area of city can be addressed but the crucial thing which has to be studied is security issues, on which more efforts can be taken for protected transmission of data.

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