A Review On IoT Based Smart Home Using Blynk Framework

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ABSTRACT

The project discussed here is designed to control and monitor appliances via smart phone using Wi-Fi as communication protocol and raspberry pi as private server. All the appliances and sensors are connected to the internet via NodeMcu microcontroller, which serves as the gateway to the internet. Even if the user goes offline, the system is designed to switch to automated state controlling the appliances automatically as per the sensors readings. Also, the data are logged on to the server for future data mining. The core system of this project is adopted from the Blynk framework.

Keyword: - Blynk, IoT, NodeMcu, Raspberry Pi, Smart Home, Smart Cities

1. Internet Of Things:

Today, internet has become an integral part of people's lives, influencing the daily activities of almost every human being. Evidently, every second smart phones with sophisticated functionalities are released out in the market. It infers that internet users in accordance with the booming smart phone use are multiplying vigorously day by day. Thus, connecting everything possessed by a human to the internet and subsequently monitoring and further controlling through smart phones is the ultimate goal of this project.

IoT is the area of network in connection with consequences, result and actions via internet allowing them to send and receive data [3]. Here, things are connected among themselves without human intervening for automatic identification of intended activities. IoT helps in sharing of information from sensors through wireless network, achieving identification and informational exchange in open computing network and achieving transparent management of system. Things that we are using in our daily life are becoming smart with the current technologies but it isn't enough until we link them to act with the changing environment and additionally make their own inter-network, that is, machine-to-machine communication.[3]

In a dynamically changing city areas, creating and maintaining public transport system, smart provision of electric energy, water and gas distribution systems, waste management and maintenance of the city infrastructure like roads and public parks are some of the challenging activities to be taken care of. We believe these complex systems will be better addressed with IoT technology.

2. Review of Technologies Related:

A. Arduino Uno [2]

When we talk about IoT there is basic involvement of certain technologies. So here we will showcase these essential building blocks for IoT. We need to have a good internet connection which forms the backbone for data transfer. Internet is a necessity so that you can transfer the sensed data from the nodes to the master hub.

Conversely, if internet is not present, technologies like radio frequency, Bluetooth and Wi-Fi can be used for low proximity data transfer and for long range distance communications, IoT technologies like ZigBee, Lora etc. can be implemented to cater the data transfer. The above technologies only cover's the communication part, but also, we need some type of device to process the data. This is where the microcontroller devices come in picture. The industry is flooded with vast range of devices ranging from raspberry pi, to BeagleBones to nodeMCU, but the king of IoT based devices has been and is ARDUINO.

The reason behind ARDUINO's popularity is easy to use IDE, open source documentation and a very vast community of active Arduino developers. Another key reason behind its wide acceptability is its low expensiveness and miniature footprint. The programming of Arduino is done in C, C++. The IDE provides various built in examples and codes that make working with Arduino an effortless task.

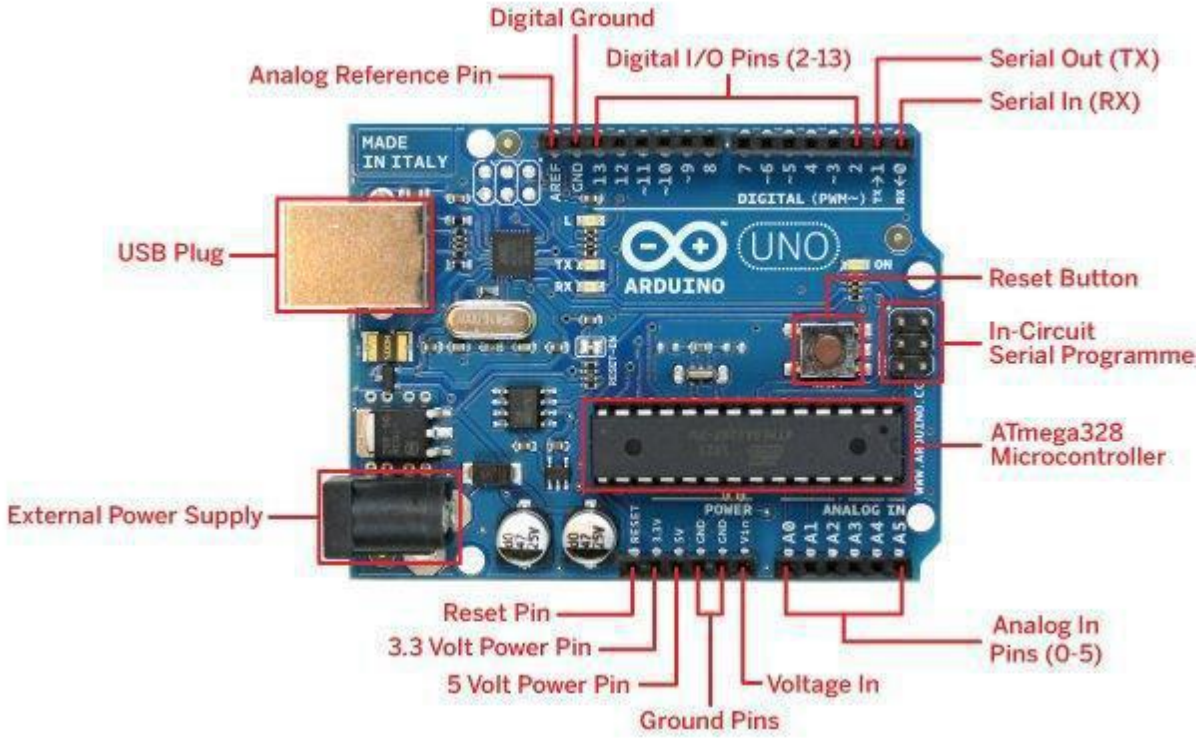

Fig 1: Arduino Uno pin description and overview.

Arduino Uno is a microcontroller board based on the ATmega328P.It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. You can tinker with your UNO without worrying too much about doing

something wrong. In the worst-case scenario, you can replace the chip for a few dollars and start over again.

"Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform.

B. Blynk [2]

Blynk is a platform with iOS and Android apps to control Arduino, Raspberry Pi and the likes over the Internet. It's a digital dashboard where you can build a graphic interface for your project by simply dragging and dropping widgets. It's really simple to set everything up and you'll start tinkering in less than 5 mins. Blynk is not tied to some specific board or shield. Instead, it's supporting hardware of your choice. Whether your Arduino or Raspberry Pi is linked to the Internet over Wi-Fi, Ethernet or this new ESP8266 chip, Blynk will get you online and ready for the Internet Of Your Things.

Fig 2: Blynk app overview.

Blynk was designed for the Internet of Things. It can control hardware remotely, it can display sensor data, it can store data, visualize it and do many other cool things.
There are three major components in the platform:

Blynk App: – It allows you to create amazing interfaces for your projects using various widgets which are provided.

Blynk Server: – It is responsible for all the communications between the smartphone and hardware. You can use the Blynk Cloud or run your private Blynk server locally. It's open-source, could easily handle thousands of devices and can even be launched on a Raspberry Pi.

Blynk Libraries: – It enables communication, for all the popular hardware platforms, with the server and process all the incoming and outcoming commands.

Now imagine, every time you press a Button in the Blynk app, the message travels to the Blynk Cloud, where it magically finds its way to your hardware. It works the same in the opposite direction and everything happens in a blynk of an eye.

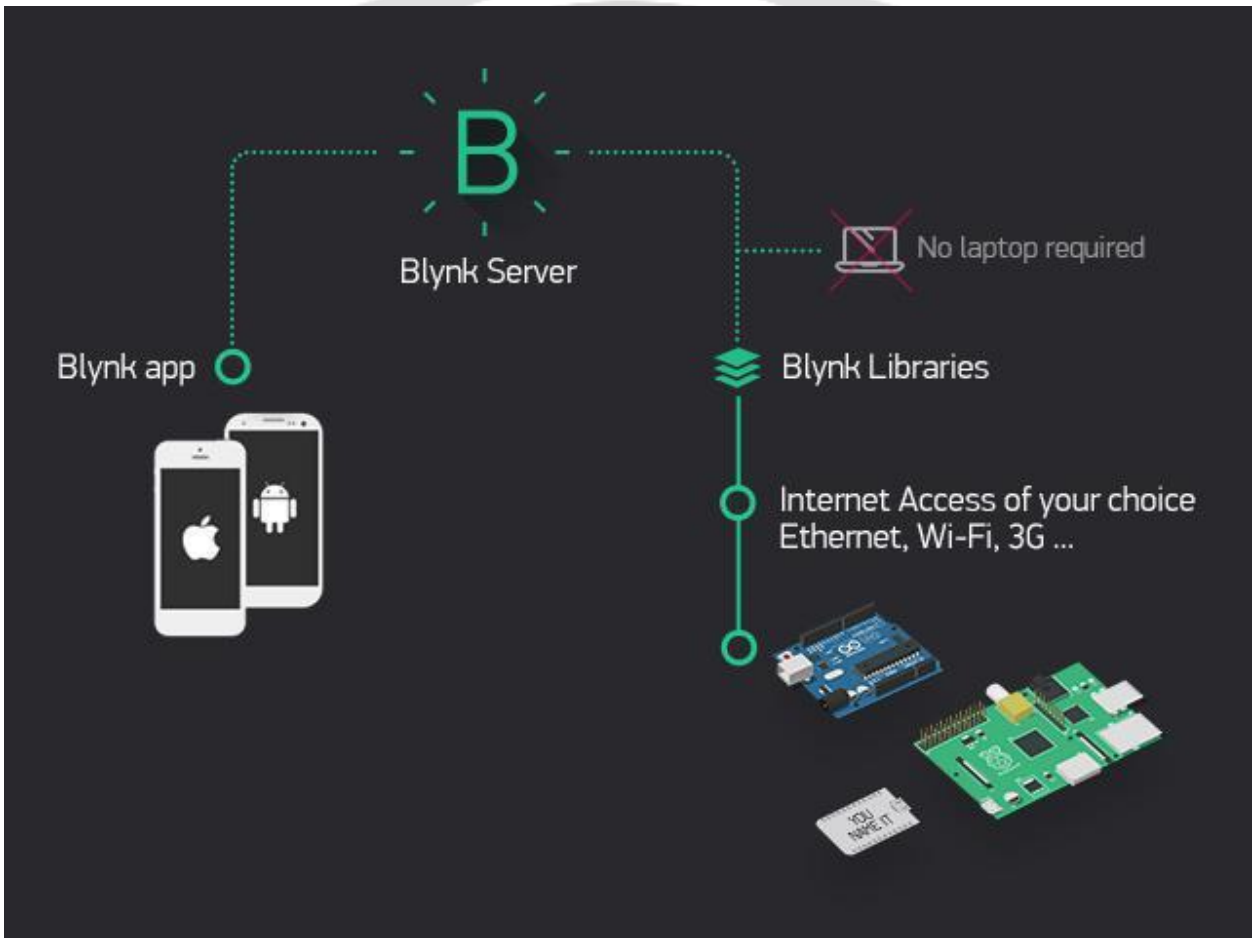

Fig 3: Blynk cloud architecture.

Characteristics of Blynk are:

- Similar API & UI for all supported hardware & devices
- Connection to the cloud can be done using Ethernet, Wi-Fi, Bluetooth, BLE and USB (Serial)
- Set of easy-to-use Widgets
- Direct pin manipulation with no code writing

- Easy to integrate and add new functionality using virtual pins
- History data monitoring via History Graph widget
- Device-to-Device communication using Bridge Widget
- Sending emails, tweets, push notifications, etc.

C. Sensor Units [1]

A myriad number of sensors are being used in this system to measure various parameters of environment. The system decisions and operations are controlled by the sensors readings. Ambient temperature and humidity is measured by DHT11 sensor, water-level in tank is incessantly measured by ultrasonic sensor, motion is detected by IR sensor and path/ location of a remote vehicle is tracked by a GPS sensor.

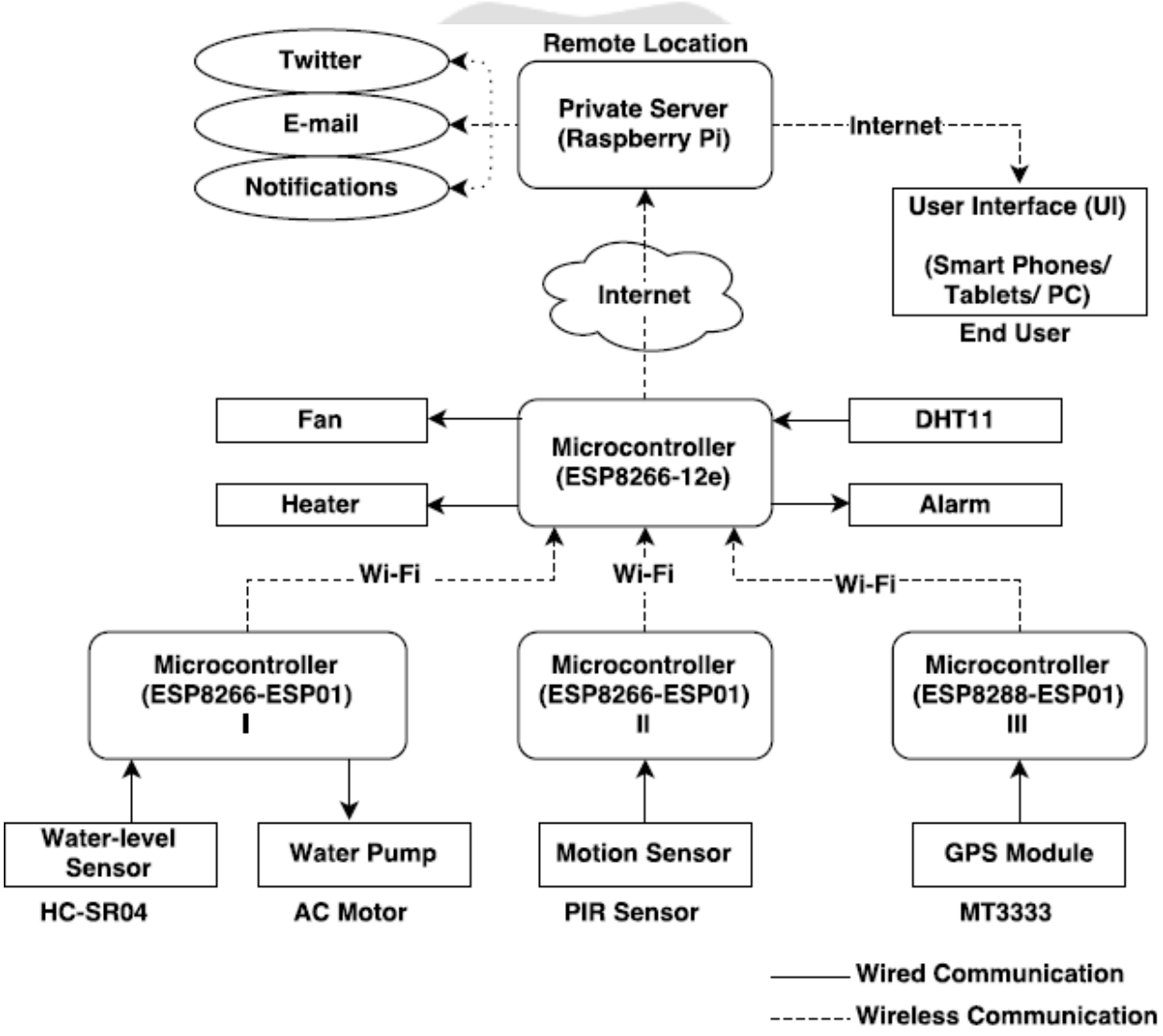

Fig. 4: Schematic Plan of the Project [1]

3. Basic Survey

The proposed prototype of the system was designed and exhibited on the 13th National Technological Festival, Locus-2016, Pulchowk campus, Nepal.

3.1 Problem Statement And Significance

In cities, most of the people are job-indulged and are busy at the day time, which, unfortunately, is low peak-load hour when electricity is available at home. On the other hand, at the time when people reach their home, everybody turn ON their appliances that makes peak load hour, where load-shedding is scheduled to maximum extent. So, there is a need of a system that can automate household tasks such as filling water tanks, charging devices and such, in the absence of the house owners.

4. WORKING OF THE SYSTEM

The system consists of three isolated sub-systems: first subsystem consisting of GPS module to get the geo-location, second sub-system consisting of multiple sensors DHT11 temperature sensor to measure temperature, PIR sensor to detect motion and ultrasonic sensor to measure the distance, and the third sub-system consisting of a master microcontroller which function as the central coordinator that communicates with other subsystems via Wi-Fi. The master microcontroller is also interfaced with a relay module to control the appliances at the site. The sensor data are fetched to the user interface facilitated by smart phones or tablets from the various sensors using a raspberry pi as the private server.

Basically, control of turning ON or OFF the whole system is at owner's hand. As the system gets powered up, it searches for the preset SSID (Service Set Identifier) and connects automatically to the Internet otherwise remains offline and performs the automated-controlling job that doesn't require commands from the owner.

Sensors accumulate disparate ambient-conditions and transmit them to the Microcontroller which processes the data transmitted by each sensor separately and then concurrently send the acquired data to the web server. The readings of each sensor can be accessed by the user from any place at any time. Additionally, all the sensors data are logged per second for future data analysis purpose. Data-logging is done both in microSD card and in the server.

The system operates in two modes automatic mode and manual mode. When it is set at automatic mode, all the home appliances like fan, heater, etc. are automated to operate as per the surrounding environmental conditions sensed by the sensors. On the other hand, when it is set at manual mode, the user can locally or remotely monitor and control each of the home appliances via her smart phone or from her office desktop PC. To recapitulate, the surveillance and control of entire household appliances is under her finger tip.

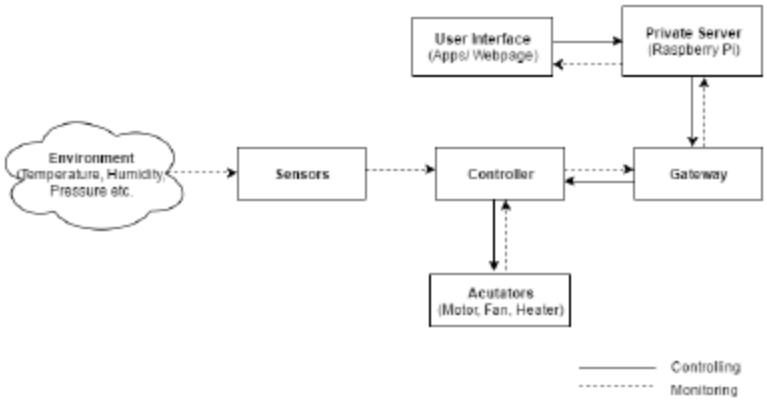

Fig. 5: Working Plan of the Proposed System

Beyond auto-manual mode of operation, some of the activities like regular water level (in water-storage tank) inspection and turning ON or OFF the water pump, ringing alarms when detecting human-presence at the door which can also be used for security by installing the motion detectors on home or office so as to alert owner remotely. The user doesn't need to switch these devices at regular interval as they are self run under the commands of the microcontroller continuously round the clock.

Similarly, some of the alert signals and warnings like house on fire, gas leakage, intruders detection etc. are wirelessly conveyed and notified about the situation to the house owner via e-mail and phone notification. Using GPS, the owner can track and locate her car at any moment from anywhere. To sum up, IoT provides greater extent of security- physical as well psychological.

5. RESULTS AND APPLICATIONS

Three different isolated sub-systems : i) relay module system connected to the home appliances to be controlled ii) GPS module and Temperature sensor connected system iii) PIR sensor for motion detection and ultrasonic senor for measuring the water level in the tank were linked to one another via Wi-Fi using NodeMcu controller chip. For user interface, android version of Blynk app with custom designed layout and buttons was used to facilitate monitoring and controlling various connected things.

The screenshots of the results of the designed system obtained on android application are shown in Figure 6. By pressing virtual button on the smart phone, the home appliances can be controlled from any remote location.

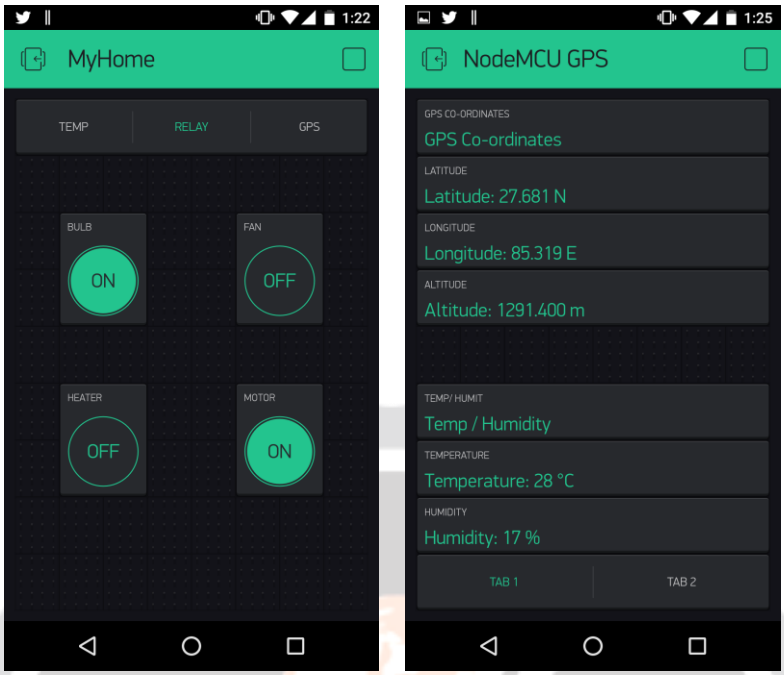

Fig. 6: Screenshots showing appliance switches and sensor outputs

One advantage of this app is that it can be shared within all the family members of the house. When one member switches ON or OFF an appliance, the action will be apparent to all other members sharing the app. Similarly, real-time as well as historical data of measurements of temperature, humidity, GPS location and distance-measure can be obtained from anywhere using the app.

Further, this system can be employed in many places such as banks, hospitals, laboratories, traffic stations, residential apartments, house, streets, poultry farms, greenhouse, etc. In a nutshell, this system can be used at multiple fields and areas in order to make them operate smartly.

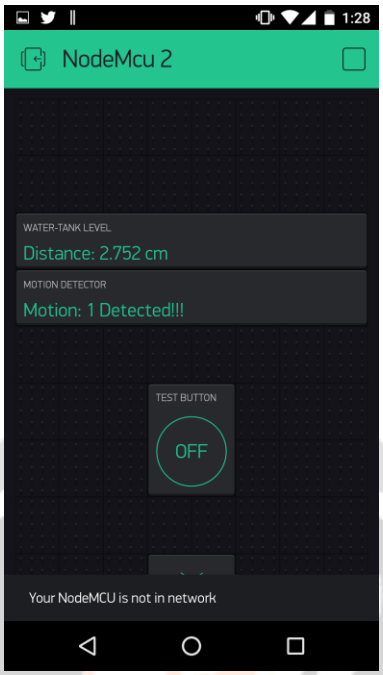

Fig. 7: Screenshots showing distance measured and motion detected.

5. CONCLUSION

In this paper, introduction of a home management and security system is done. This paper is mainly focused on overcoming everyday problems faced by the people in power cut-off, unmanaged urbanization, lack of manpower in agriculture and farming, etc are blatantly evident. Our prototypical system is applicable to real-time home security, automation, monitoring and controlling of remote systems.

6. REFERENCES

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