Internet of Things Based Home Monitoring and Device Control Using Esp32

V. Pravalika, Ch. Rajendra Prasad

Abstract— This paper presents a low cost flexible and reliable home monitoring and control system with additional security using ESP32, with IP connectivity through local Wi-Fi for accessing and controlling devices by formal user remotely using android smart phone application. This system is server self-governing and uses internet of things to control human desired appliances starting from industrialized machine to user goods. Home monitoring and device control system not only refers to decrease human efforts but also save the energy and time competence. To demonstrate the effectiveness and feasibility of this system, in this we presents a home monitoring system by using ESP32 module. It helps the user to monitor various conditions in the home like room temperature, gas leakage, water levels in the tank and person detection and control various appliances such as light, fan, motor, gas knob and take decision based on the feedback of sensors remotely.

Keywords: ESP32, Internet of Things (IoT), Wi-Fi network, PIR(passive infrared) sensor.

I. INTRODUCTION

The day by day innovation improved from automatic machine to customer products. IoT is another pattern advancement that empowers us to screen and control hardware devices through the web. Here we propose to use IoT in order to screen and control home apparatuses, in this way computerizing present day homes through a web. This proposed framework enables a consumer to effortlessly control these home apparatuses through the web. The undertaking proposes a capable usage for IoT utilized for checking and controlling the home apparatuses by means of World Wide Web. Home robotization framework utilizes the reasonable gadgets as a UI. They can likewise speak with home computerization organize through an Internet access, by strategies for low power correspondence traditions like Zigbee, Wi-Fi, etc. This endeavor goes for controlling home machines by methods for Smartphone using Wi-Fi as correspondence tradition and raspberry pi as server structure. The IoT based Monitoring and Controlling System for home is a progression which can control and screen gadgets not just for home mechanization but any real life appliances remotely. It provides facility to have control over a wide range of home appliances and ensure securities.

In this project we presented implementation of home automation system through the Wi-Fi module, Massachusetts Institute of Technology (MIT) app. and Webpage server using ESP32. This project monitors all home appliances such as light, fan and controlled based on the threshold value programmed in the ESP 32. This system is low cost, allowing additional home appliances. Home monitoring and device controlling without involvement of humans the system can be control the devices, So that we can save the time and energy levels. So now we have introducing this system.

The fig.1 shows the architecture of the system here we are using the four sensors and four devices for the home appliances for monitoring and controlling devices for the home respectively. The data can be sending to open source cloud storage for the store the data and use the MIT app Inventor for display the status of the sensors.

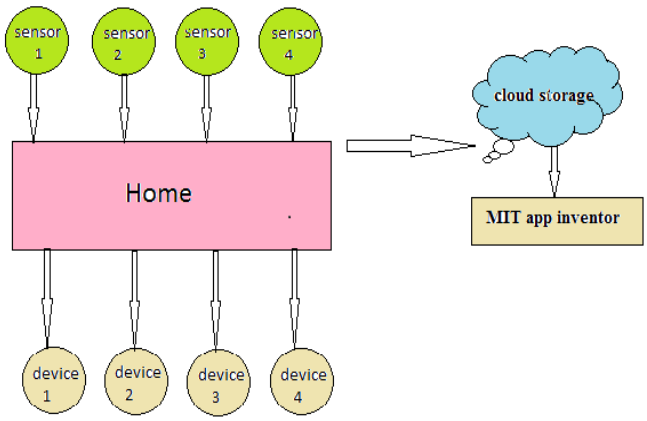

Fig.1.Architecture of IoT based home monitoring and device control

II. RELATED WORK

In [1] article, the authors presented design and development of control of home appliances system through the Wi-Fi module, webpage server and Arduino. The user communicates with arduino through internet via Wi-Fi network.

In [2] Based on SMS/GPRS cell phone and inserted module including oneself sorted out home computerization framework, it tends to be coordinated to permit the client end to screen and control the gadgets for the home apparatuses by means of sent the message however the portable phone.

In [3] Cloud computing is defined as storing the data in the cloud and running the applications which are connected with it. Everything is hosted in the cloud, which is connected to many computers and servers through internet. In [4] authors presented remote monitoring and control system based on both GSM-Bluetooth and GSM technology. The Bluetooth was employed for short range where as GSM

Revised Manuscript Received on June 10, 2019.

V. Pravalika, M.Tech Student, Department of ECE, S R Engineering College, Warangal, Telangana, India. (velmareddy.pravalika@gmail.com)

Ch.Rajendra Prasad, Asst. Professor , Department of ECE, S R Engineering College, Warangal, Telangana, India. (rajendra_prasad_ch@srecwarangal.ac.in)

is used for remote communication. The system is planned to control lights, temperature and also to detect unauthorized intrusion.

In [5] acquainted with plan of a home mechanization and security framework dependent on an independent inserted framework leading body of ADK. The essential features of the proposed system are light controlling, Smoke distinguishing proof and Temperature Sensing.

The plan of an ongoing remote home computerization framework subject to Arduino Uno microcontroller has been proposed [6]. The physically robotized mode where the customers are allowed to screen and control their home machines over Wi-Fi advancement. Self automated mode that allowed the Arduino Uno microcontroller to screen and control particular apparatuses in the home physically in light of any signs from specific sensors.

In [7] GSM based home security system which can help detect and prevent various accidents by warning the person responsible in the right time. Various accidents occurring due to fire and LPG leakage can be prevented by incorporating the project in the homes.

In [8] the paper proposes a novel security structure subject to Open source cloud server "things speak.com" and an inconsequential effort esp8266 Wi-Fi module. This unites a PIR sensor which constantly viewing the individual divulgence in the home. Right when the PIR module perceives an intruder it sends a pennant to the At mega 328p microcontroller and the controller is connected with an Esp8266 Wi-Fi module what's more to a prepared structure. The PIR sensor transmits a prepared sign to the Open source cloud which gives an alert banner to the customers anyway the cell phone.

In [9] Smart home security has moved toward becoming completely pre-prominent in everyday life of family unit and modern works. Home security is to some degree that is pertinent to us all and includes the equipment and an individual security practice. The equipment would be the entryways, alerts, lock frameworks and distinctive kind of sensors like PIR sensor, Temperature sensor, gas sensors to recognize un positive condition. In [10] authors introduced dynamic adaptive a sensor based pedestrian crossing system at traffic junctions. In [11] the authors introduced power network monitoring using embedded Web server. The system employs LPC2148 and embedded TCP/IP Rabbit Core Module 5170.

III. PROPOSED WORK

In the literature different solutions proposed to this problem, but all of these involve complex circuitry and high-level knowledge required to operate these systems. But the proposed project does not require any profound knowledge of the hardware or software. By summarizing all the previous completed work, there are some drawbacks in them. To overcome those drawbacks, we are using an efficient way by employing esp32 and connecting them to cloud and retrieving the data to MIT app inventor. There are no systems which exactly do the same work. But the present system easily to monitoring and controlling the home appliances and easily updates to open source cloud and then it automatically updates those same values to the MIT app inventor.

The system consist of a four sensors temperature sensor, PIR sensor, gas sensor, water level sensor and using the ESP32 module. By using an IoT the ESP32 send the commands to cloud storage things speak. The cloud storage things speak it will receive the commands and shows the response.

The system it is also using the MIT app inventor it shows the sensor status. When the internet is not available the system uses the buzzer it will give audio signaling when the water level reaches the threshold value and when the person entering into the home. The planned framework screen the sensor information, similar to temperature, gas, light, movement sensors, yet additionally activates a procedure as per the prerequisite, for instance exchanging on the globule when it gets dull. It additionally stores the sensor information in the cloud. It will assist the client with knowing the states of different parameters in the home at anytime anywhere.

The proposed system block diagram as shown in fig.2.The system consists of two major parts: (i) hardware implementation and (ii) software implementation. There are different sensors are used in the block diagram they have similar operation but has different working principle. These sensors are individually connected to the esp32.we are using the 4-channel relay for connect the different devices.

In this project we are using the open source cloud storage is connected to MIT app inventor. The sensor blocks record the values of like temperature, gas, PIR values and water level. The cloud storage things speak it will shows the response and values should be display on the MIT app inventor (dashboard). If there is a raise of the values of temperature detects these values and gives it to ESP32. This block continuously updates values to the cloud and then retrieved to operator dashboard. If the recorded value exceeds the predefined threshold level, then the operator dashboard is notified with an alert.

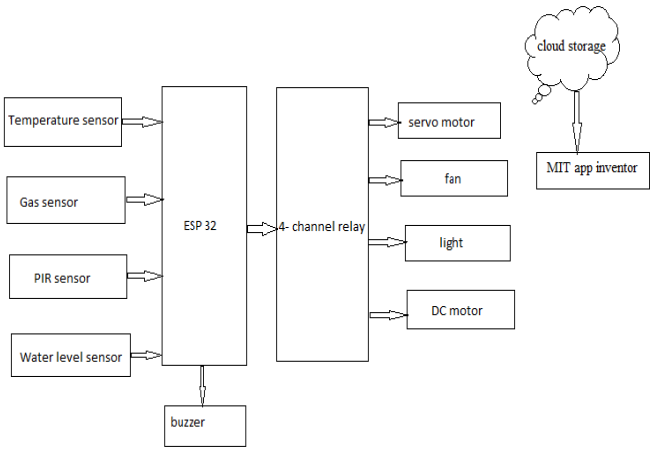

Fig.2. Block diagram of the proposed system

(i) Hardware Description

ESP32: It is a less-cost, little power system on a chip microcontroller with included Wi-Fi and dual mode Bluetooth. The ESP32 is the heart of the project. It is a

microcontroller board used to connect all the sensors. The board is programmed with the source code in order to perform the operations of the project. The source code is stored in the on-chip memory available on the ESP32. This block can be considered as an interface between the programmer and the user. So, it is considered as the heart of the project. The ESP32 operating voltage range is 2.2 to 3.6V. Under normal operation the ESP32 thing will power the chip at 3.3V. The pin description of ESP32 is shown in fig.3.

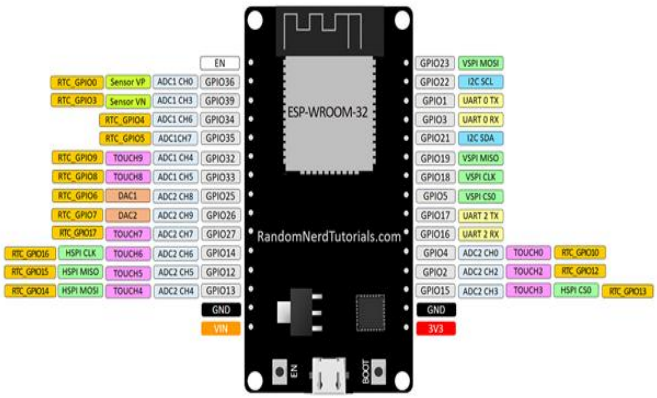

Fig.3.Pin description of ESP32

Gas Sensor: The MQ-3 Gas Sensor identifies gas leakage in home and industry. The MQ-3 arrangement of gas sensors utilizes a little radiator inside with an electrochemical sensor. They are delicate to a scope of gasses and are utilized inside at room temperature. These are utilized in gas spillage uncovering of LPG, propane, methane, i-butane, alcohol, Hydrogen, and smoke. It is a low cost semiconductor sensor which can detect the presence of gases at concentrations range from 0.05 mg/L to 10 mg/L.

Fig.4.Gas sensor

PIR sensor: Passive Infrared sensor identifies a humans or animals being moving within about 10m from the sensor facet. In this project, the sensor is employed for presence of humans in the room and send signal to the ESP32. It is used to detect the infrared light radiated by a warm object.

Fig.5.PIR sensor

Relay Module: In this project relay is an important component and which is employed to control high voltage home appliances. We employed 5V four channel relay to control four appliances. This is having four controlling inputs, Vcc, GND and four outputs. The outputs of relay are connected to four appliances and these are controlled by using control inputs which are connected to four digital output pins of ESP 32.

Fig.6. 4-Channel relay

Water level sensor: Water level module is used to find the level of liquid content that can flow. Such consist of Water, granular, slurries objects and powders. Level measurements can be done inside containers or it can be the level indication of a tank. The ouput of this sensor varies from 0 to 5V and 0V represents minimum water level and 5V is the maximum water level.

Fig.7.Water level sensor

Servo motor: Servo motor works on the principle of servo mechanism. It consists of a suitable motor attached to a sensor for position feedback. This motor can rotate only from 0^o to 180^o. This motor is having three pins. Two pin are power pins and reaming pin is used as input for servo motor.

Fig.8.Servo motor

Buzzer: A bleeper or buzzer is an audio alarm device, which may be electromechanical mechanical, or piezoelectric. Typical uses of beepers include alarms, and timers, verification of user input such as a keystroke.

Fig.9.Buzzer

Temperature sensor: The LM35 is linear monolithic temperature sensor.The operating range of the temperature is suitable for home environment. LM 35 is having three terminals named as VCC,OUTPUT,GND.For every one degree raise in temperature the output voltage of sensor is 10 mV.The output of sensor is linearly colibirate degree centegrade.The pins of LM35 as shown in fig10.

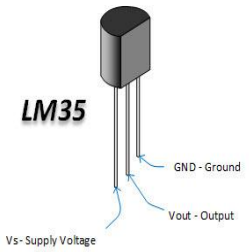

Fig.10.Temperature sensor

(ii) Software implementation

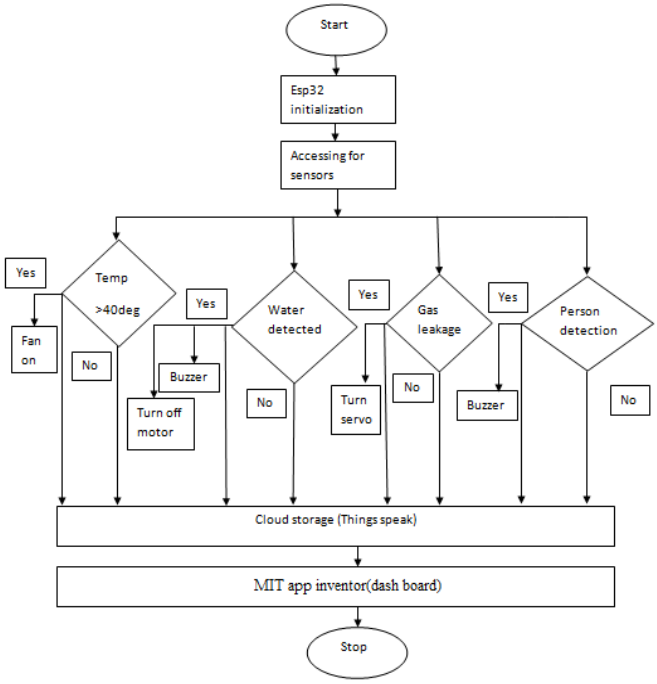

Fig.11.Proposed system Flowchart

The flowchart as shown in Fig.11 describes the software implementation of the proposed system. This system monitors the temperature value, water level in the tank, gas leakage and person detection values. If the temperature value exceed then the threshold value fan on else fan off the value store in the cloud. If the water level reaches the threshold value turn off motor or buzzer on the values stores in the cloud. If when the gas leaks in the home turn servo the values store to the cloud. If the person is detected buzzer on goes to cloud else the value store in cloud. The values should be display on the MIT app inventor (dashboard).

IV. RESULTS

In fig. 12 connections of the system are made and the whole setup is embedded into a small box to be resistant of all conditions. The sensors record the values of home monitoring and device control of various types they are temperature, gas, PIR and water levels. The recorded values are should monitor on the cloud storage thing speak.

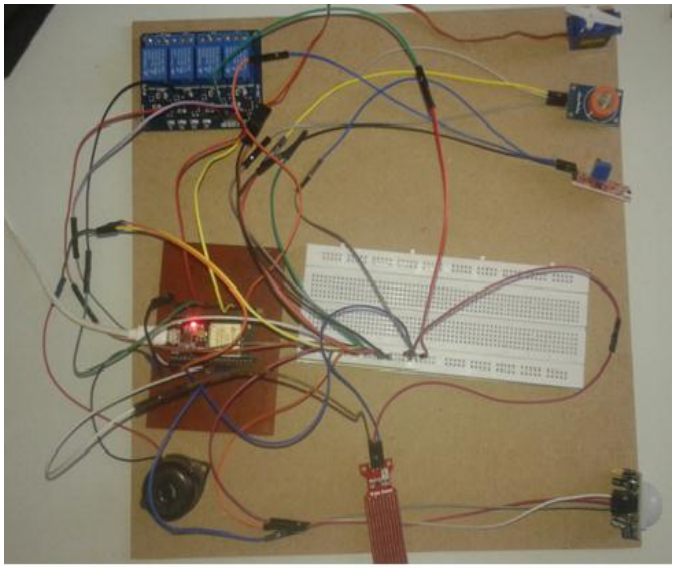

Fig.12. Connections of IoT based home monitoring and device control

The ESP 32 continuously updates values to the cloud and then retrieved to MIT app inventor. Fig.13 shows the Things speak channels updated values of gas, temperature, water level and PIR values. If the recorded value exceeds the predefined threshold level, then the operator dashboard is notified with an alert signal by using the buzzer.

Fig.14 Shows the all sensor values like temperature value is 13, PIR value is 1 ,water level flows in the tank it shows the 4 and gas leakage value it display the 459 value different types of sensor status of the different values and it will show the actuators status.

Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication

Fig .13.Things speak channels showing gas leakage, water level, temperature and PIR sensor value

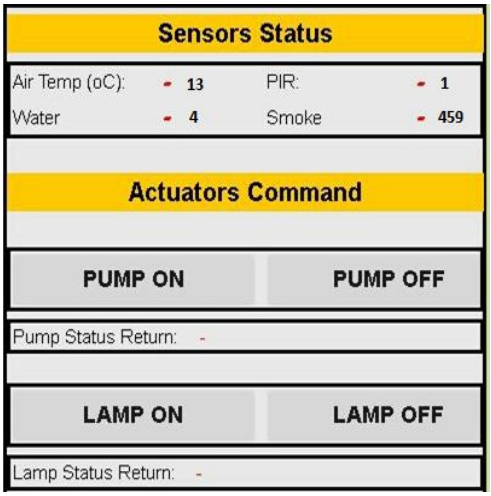

Fig.14. Updated values of temperature, PIR, water level, gas sensor

V. CONCLUSION

We presented a system which can monitor and control multi devices at home using IoT.This proposed system improve the performance of various devices at home by controlling automatically and remotely. The system works in three phases. In first phase the system monitors temperature, gas leakage, water level of the tank and person detection and upload the data to cloud (things speak) and mobile app (MIT app inventor). In second phase the system automatically controls the motor pump and gas knob when water level reaches the maximum and gas leakage detected respectively. In third phase user can control home appliances like fan, light etc using mobile app. The system in build using low cost embedded microcontroller with Wi-Fi module ESP32.The developed system cost is low, simple to operate and is easily embedded with home appliances.

REFERENCES:

1. M.Tazil, R.Piyare "Bluetooth Based Home Automation System Using Cell phone," in IEEE 15th Int. Symposium on Consumer Electronics, Singapore 2011, pp. 192 - 195.
2. Md. Abdullah Al Asad, Md. S. Faruk. Design and Development of SMS Based Wireless Home Appliance Control and Security System. JMST, Vol.3. No.1. Mar. 2015, Issue. pp.80-87.
3. N.Deepak, Ch. Rajendra Prasad " Patient Health Monitoring using IoT", IJITEE, Volume-8 Issue-2S2 December-2018.pp. 454-457.
4. V. Madan, Reddy S.R.N "GSM-Bluetooth based Remote Monitoring and Control System with Automatic Light Controller", Int. Jr. of Computer Applications, Vol. 46, No 1, pp. 20-28, May 2012.
5. D. Javale, M. Mohsin, "Home Automation and Security System Using Android ADK", Vol. 3, Issue 2, pp 382-385, Mar. 2013.
6. B.M.O. Al-thobaiti, I.I.M. Abosolaiman "Design and Implementation of a Reliable Wireless Real-Time Home Automation System Based on Arduino Uno Single-Board Microcontroller", Vol. 3, No. 3, pp 11-15, July 2014.
7. Diptanil Chaudhuri "GSM based home security system" IJETR, Vol.3, Issue-2, Feb. 2015.
8. Safa.H, Sakthi Priyanka," IOT based Theft Premption and Security System", Int. Jr. of Innovative Research in Science, Engg. and Tech., vol 5, pp. 4312-4317, Mar. 2016.
9. Pandav R.P., Dahatonde S.P " Security System And Home Appliances Control Using IoT" IJARIIE Vol-4 Issue-2 2018.
10. O.Anusha, CH. Rajendra Prasad" Experimental Investigation on Road Safety System at Crossings " IJEAT, Volume-8, Issue-2S2, January 2019, pp.214-218.
11. K. Bharath Reddy and Ch.Rajendra Prasad, "The embedded Web server based Electrical Ethernet Monitoring system using ARM," Int. Jr. of Adv. Research in Comp. & Comm. Engg. Vol. 2, Issue 5, 2013, pp. 2292-2295.