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Implementation of Low Cost Home Monitoring, Controlling and Security System using IoT

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***Abstract*— This paper presents the overall design of Home Monitoring, Controlling and Security System with low cost and wirelessly using IoT. It is designed to provide the access to people who far away from their home. As it uses IOT technology, we can operate home appliances from anywhere in this world and improves the standard of living at home. By using an mobile application or webpage which got all the controls of security and household electronic things, it's made easy for controlling and supervising of the home appliances and security of the home. The installation of this system is cheap and low cost for a home without any changes in home design. It provides remote location control and manual control for the ease of elder people who is not aware of this technology. It provide the high security for the home using a method where the password is not stored in any part of the memory or code of system instead it changes every time and is in the hands of user or owner of the home at lowest cost and maintenance.**

Keywords*— *Microcontroller, NodeMCU, LCD, Motors, DHT sensor,Iot

I. INTRODUCTION

A future home is a residence that uses internet-connected devices to enable the remote monitoring, management of appliances and security systems. A home automation system will control lighting, climate, entertainment systems, and appliances. It may also include home security such as access control and alarm systems. When connected with the Internet, home devices are an important constituent of the Internet of Things. A home automation system typically connects controlled devices to a central hub or "gateway". The user interface for control of the system uses either wall-mounted terminals, tablet or desktop computers, a mobile phone application, or a Web interface, that may also be accessible off-site through the Internet. In order to provide the long distance remote Operation and all in one system for the home which makes it easier to the user to control, monitor and secure the entire home from anywhere using the IOT.

II. BLOCK DIAGRAM

It consists of two microcontrollers and a NodeMCU ESP8266 for its operation. It uses two different microcontrollers for two different operations. One is for electrical appliances control and another for security control. It has sensors interfaced to the system. Various sensors like Motion sensor, flame detector and touch sensor are interfaced to the system. It has a 4x4 keypad and 16x2 LCD display.

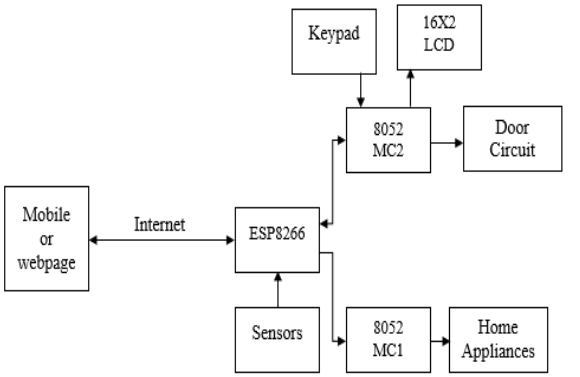

Fig 1 Block Diagram of HMCS System

A. Circuit Disription

The communication between the NodeMCU ESP8266 and appliances controlled microcontroller is parallel and that to it is a five bit data which consists of 4 bit control data and a enable bit. The 5 bit data is obtained from NodeMCU ESP8266 pins from D0 to D4 and connected to port 0 pins of 8051 microcontroller. There is a serial communication between the NodeMCU ESP8266 and Security phase microcontroller and it runs at 9600bps. Touch sensor and Motion detector is connected to security phase microcontroller whereas temperature and humidity sensor and Flame sensor is connected to NodeMCU ESP8266 directly. The electrical appliances are connected to the microcontroller MC1 through the port 0 and port 2 (extended). For microcontroller MC2 , keypad is connected to port 1 and LCD display is connected to port 2 and motor driver is connected to pins P1.2 and P1.3 and touch sensor is connected to pin P1.4. Motion detector is connected to pin P3.3 and taken as a input interrupt (INT1) to the microcontroller 2. The password request switch is connected to pin P3.2 and taken as a input interrupt (INT0) to the microcontroller. The pins P3.0 and P3.1, RXD and TXD respectively are connected to the pins D7 and D8 of NodeMCU ESP8266 respectively. Temperature sensor and flame sensor are connected to A0 and D6 pin of NodeMCU ESP8266.

B. NodeMCU ESP8266

The ESP8266 is s low-cost Wi-Fi microchip with full TCP/IP stack and microcontroller capability produced by manufacturer Espressif Systems in Shanghai, China[3]. The chip first came to the attention of western makers in August

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2014 with the ESP-01 module, made by a third-party manufacturer Ai-Thinker. This small module allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections using Hayes-style commands. However, at first there was almost no English-language documentation on the chip and the commands it accepted. The very low price and the fact that there were very few external components on the module, which suggested that it could eventually be very inexpensive in volume.

C. 8051 Microcontroller

A microcontroller contains one or more CPUs(processor cores) along with memory and programmable input/output peripherals. Program memory in the form of ferroelectric RAM, NOR flash or OTP ROM is also often included on chip, as well as a small amount of RAM. Microcontrollers are designed for embedded applications, in contrast to the microprocessors used in personal computers or other general purpose applications consisting of various discrete chips. 8052 is a 40 pin dual inline package IC which is used most of applications as it is very easy to use and maintaining. It requires simple embedded c code for its operation. It mostly used with the 11.0592MHz frequency where it gives the baud rates of 9600bps, 4800bps, 2400bps based on the value loaded in to the timer1 register while serial communication. It has 8 bit multiplexed data and address lines (AD0-AD7) and only address on port2 (A8-A15). It has 4 IO ports and can use as per our requirement and port 0, 1, 2 has no special operations individually except data and address on port 1 & 2 but port 3 has some special functions individually to each pin.

D. DHT11 Sensor

The digital temperature and humidity sensor DHT11 is a composite sensor that contains a calibrated digital signal output of temperature and humidity. The technology of a dedicated digital modules collection and the temperature and humidity sensing technology are applied to ensure that the product has high reliability and excellent long-term stability. The sensor includes a resistive sense of wet component and an NTC temperature measurement device, and is connected with a high-performance 8-bit microcontroller.

Only three pins are available for use: VCC, GND, and DATA. The communication process begins with the DATA line sending start signals to DHT11, and DHT11 receives the signals and returns an answer signal. Then the host receives the answer signal and begins to receive 40-bit humiture data (8-bit humidity integer + 8-bit humidity decimal + 8-bit temperature integer + 8-bit temperature decimal + 8-bit checksum).

E. Flame Sensor

A flame detector is a sensor designed to detect and respond to the presence of a flame or fire, allowing flame detection. Responses to a detected flame depend on the installation, but can include sounding an alarm, deactivating a fuel line (such as a propane or a natural gas line), and activating a fire suppression system. When used in applications such as industrial furnaces, their role is to provide confirmation that the furnace is working properly; in these cases they take no direct action beyond notifying the operator or control system. A flame detector can often respond faster and more accurately than a smoke or heat detector due to the mechanisms it uses to detect the flame.

F.Motion Detector

A motion detector is a device that detects moving objects, particularly people. Such a device is often integrated as a component of a system that automatically performs a task or alerts a user of motion in an area. Passive infrared (PIR) sensors are sensitive to a person's skin temperature through emitted black-body radiation at mid-infrared wavelengths, in contrast to background objects at room temperature. No energy is emitted from the sensor, thus the name passive infrared. This distinguishes it from the electric eye for instance (not usually considered a motion detector), in which the crossing of a person or vehicle interrupts a visible or infrared beam.

F. Other Components

- 16x2 LCD Display
- 4x4 Keypad
- Relay Modules
- LED’s
- Push Bottons
- DC Motors
- Motor Drivers
- +5V, +12v DC supplies
- 12MHz Crystal
- 33pF Capacitors - 2
- 8051 Microcontroller board
- Programming cable

G. Software Requirements

- Proteus Software
- Keil Software
- Progrisp
- Arduino Software

III. WORKING AND SIMULATIONS

Initially NodeMCU is connected to the WI-FI, specified in the program. The NodeMCU is connected to the webpage that is provided in the program using the MQTT protocols. Now it is able to receive the data from the webpage or to write the data on to the webpage. By clicking on the button attached with key word to control that particular thing. The change in the webpage after clicking is read by the NodeMCU using the MQTT protocol and perform the operation assigned to the change. And there by the operations are send to microcontroller which is connected to the all controllers. 8052 micro controller receives the data from ESP8266 and changes the output on its pin to the corresponding value to make an action. There are indicators which provides us the information gathered from the sensors.

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A. Simulations of the project

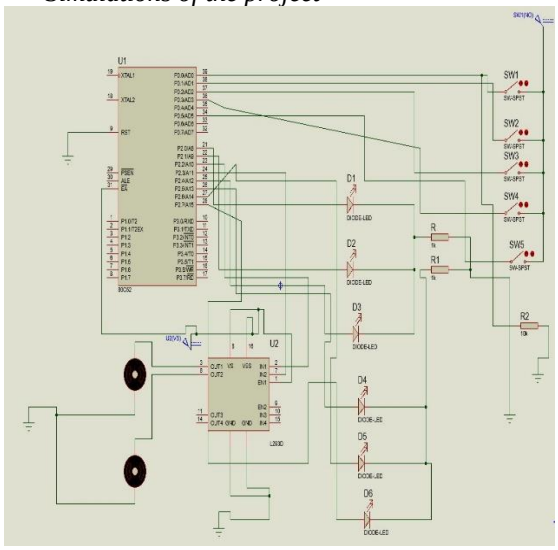

Fig 2 Simulation of Controlling home appliances

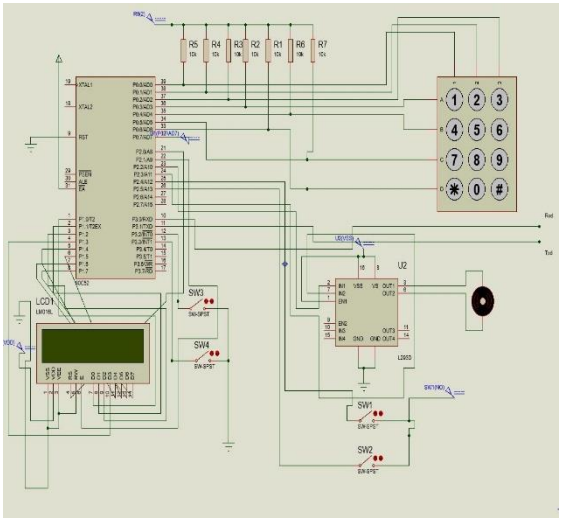

Fig 3 Simulation of Security Deployment of System

B. Advantages

- Password varies every time a new request received
- Long distance monitoring
- Easy to monitor and control
- Less wiring required
- Manual control is available
- Easy to implement with old system
- Less cost

C. Limitations

- If internet connection lost, communication will stop until internet is ON.
- Need different DC supplies for different circuits to avoid low supply problems (More supplies required).

IV. RESULTS

A. Security Section

In the initial, the system will show the **Request Password** on the display as shown in below figure.

Fig 4 Displaying Request password in LCD

If the user press the request button provided, then the request interrupts the processor and send the request signal to the admin through the NodeMCU, and displays the **Please Wait** on the LCD display as shown in below figure.

Fig 5 Displaying Please Wait on LCD

At this stage, the microcontrollers wait for the password from the admin which come through the NodeMCU. Then after receiving the password, it asks the user to enter the same password as what it receives. If the user enter the correct password it displays **door opens** and door will open otherwise it shows **sorry wrong password** on display,

B. Appliances Control

For home appliances control, the admin will send the data to NodeMCU for which the control operation is assigned and the things will turn ON and OFF depending on what data the admin sending.

For example if the data sent by the user is 0001 and the enable pin is made high then the Second LED will turn ON until the admin transmit the same data again to turn OFF operation which is shown in below figure.

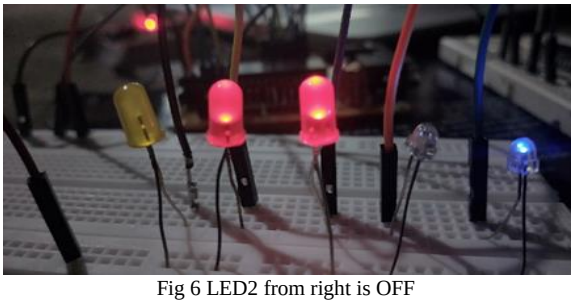

Fig 6 LED2 from right is OFF

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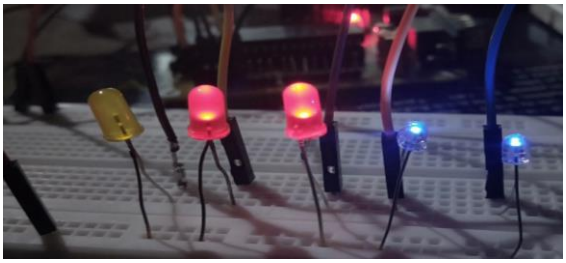

Fig 7 LED2 is made ON

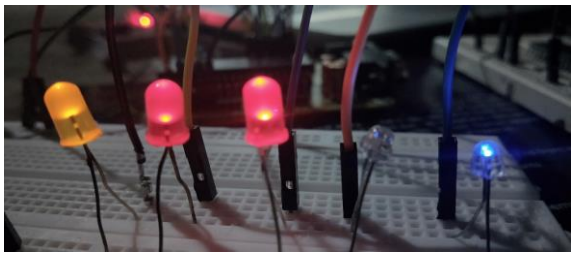

Fig 8 LED2 is OFF and LED5 is ON

C. *Controlling Dashboard*

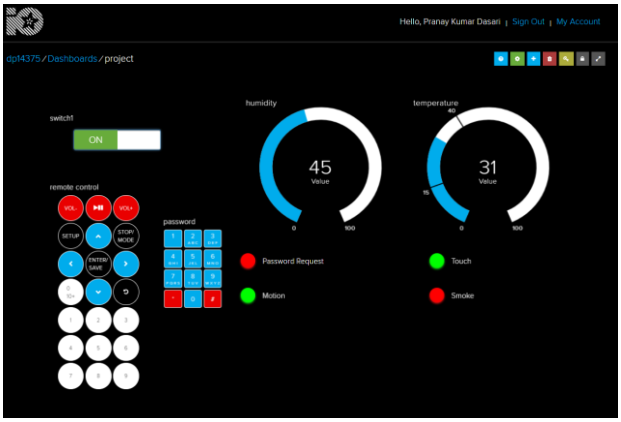

Fig 9 Dashboard with controls and indicators

The dashboard that admin has control over the HCS system is designed in the website/application using the 10 feeds and the dashboard has triggers to control the appliances.. If there is a person roaming infront of the door then the PIR sensor will detect the moving person and send the signal to admin dashboard or mobile thourgh the internet. If there is any movement infront of the door the motion led will glow red other wise oit glows green. If the user at the door press the button provided to request the password from the admin. Then that request will interrupt the MC2 operation and sends a password request signal to nodemcu esp8266 and it will publish the request siganl on the webpage on password request led as shown in below figure 4.13. If the person at the door try to open the door forcely then the handle will send a signal as touch to the dashboard. It will turn red if anyone tries to open the door without permissin or try to break the door with any kind of equipment, it detect that treat and display the threat signal on dashboard. when there is a fire accident occurs, it will intimate the admin as fire alert at the home on smoke/fire alert led. If the admin send the request for the home temperature and humidity by clicking on switch provided on dashboard, the NodeMCU receives the temperature and humidity data from DHT11 sensor and update the value to the dashboard.

D. *CONCLUSION*

As the technology increasing, the home appliances and security systems are given more priority to develop a smart home. By using this system, a person can control, monitor and secure his home from anywhere in this world if he has an internet access. It is cheaper and can easily implemented with the regular home appliances. It makes a home more secure and smart within our hands.

E. *FUTURE SCOPE*

By using the latest processors and microcontrollers like PIC, AVR and ARM, it is easy to implement a system that can be used to monitor and control of large building with many rooms and floors. By using google talk, it is possible to control this system with the voice (keywords) By using the Zigbee or Bluetooth or using RF communication, it is possible to make internal connections as wireless but it is not cost effective.

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