Integrated Home Automation and Security System Using Arduino MEGA and GSM

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Abstract—Home automation is today’s need of every home maker or house owner the most important thing is that one's home is secure and safe. Home automation is ways to have things around your home happen automatically as per your desire. The project undertaken is an integration of home automation and security system thus can prove beneficial for a house owner. The single central control unit operates the different tasks of automation and security. Motion controlled light, temperature controlled ac, bidirectional counter for gate security, GSM based SMS notifications, image capturing of incoming persons, LPG leakage detection, smoke detector and smart lighting are the features added in the project and much more can be added to this system. This system is using ARDUINO Mega microcontroller kit as the controlling body. This project can have many sensors connected with Arduino kit as input devices and give their respective inputs to Arduino kit and it further operates the output devices connected to it on the basis of inputs.

The main motive of integrating the automation systems into a single integrated automation system with extendable features is to provide a level of comfort and reliability to houseowner. The system contains an IR sensor and camera based Bidirectional gate counter which gives the number of entries and departures on gate and keeps a record. [1]. The other features are just based on the inputs received from the sensors such as MQ-6(CH4 methane detector) which detects leakage of LPG, MQ-135(CO2 detector) which helps to detect the smoke level in the house, PIR human detector which detects presence of human in a specific room or space, Temperature and humidity sensor DHT-11 sensor and IR radiation sensors (LED’s). These inputs determine our outputs. The instruction code is burned in the Arduino mega kit which is written in C/C++languages.

Keywords—Home automation, Global System for Mobile communication (GSM), Infrared (IR), Light Emitting Diodes (LEDs), ARDUINO (microcontroller kit) Watermarking, Haar Wavelet, DWT, PSNR

I. INTRODUCTION

In present world, due to advancements in technology and life style people need easier ways and more time saving activities around them. Since we are now used to touch phones, voice commands, automatic gadgets and other smart gadgets, we find it difficult to turn lights on and off manually. This new psychology has emerged in people due to such technological advancements and thus there is a demand for more user friendly and automatic systems.

We have many automation systems present in market today and are reliable too, but it is uneasy to buy different automation gadgets separately and is in fact an expensive thing to do. Moreover it’s hard to maintain different gadgets. So there is a need for integrated system which carries out multiple tasks as per you're desire. The project “integrated home automation and security system” is a concept of integrating many automation systems together to do multiple tasks under one control unit. This brings a sense of reliability to owner and finds it easy to control and maintain the system and indeed will be economic in nature. The most needed thing is the customization and the flaw less security set up which can be provided by the proper authentication of user with the help of GSM to control the appliances and the execution of tasks by the system aswell.

The main purpose of the integrated home automation system is to give comfort and reliability to owner along with the security. With the advent of authentication for controlling the tasks and features the security system is flawless. The programming unites the different systems. With the help of Arduino mega which has 80 I/O pin allows greater number of devices to get connected and are made work in coordination with the particular inputs from different sensors.

II. METHODOLOGY

2.1 Home Automation usingArduinoMEGA—

The Arduino is an open source architecture micro controller kit. Arduino supports C/C++ and java languages and the integrated development environment is provided for the installing program in the microcontroller. It has ARM (Advance RISC Machine) based processor which speeds up the processing. The Arduino Uno has 20 I/O pins and can handle a small project but ARDUINO Mega has 80 I/O pins which can interface many I/O devices.
2.2 Structure and Components –
The Arduino will be fed with the source code which will operate the I/O devices logically. The smart lighting, smart AC, smoke detector alert, LPG leakage detector and temperature detector, GSM authentication/notification system and IR sensor plus camera based gate counter are implemented with the help of Arduino mega. There is no need to have a special app to control system. The only way to control system remotely is GSM based authentication via SMS.

The sensors and input and output devices are connected to Arduino mega kit on the input pins which include:
1. PIR humansensors.
2. IRsensors.
3. IRLEDs.
4. DHT-11 humidity and temperaturesensor.
5. MQ-6 LPG and flammable gassensor.
6. MQ-135 CO2sensor.
7. LCD16x2,
8. Relays forswitching
9. LEDs forlighting.
10. GSM for connecting with user.
11. Cameramodule.

III. IMPLEMENTATION

The automation tasks are done on the base of the sensor inputs. The smart lighting involves PIR human sensors and LEDs. The PIR sensors sense the human presence and the Arduino receive the input signal as active low and thus as programmed turns the lights on.[2]

The smart AC involves the DHT-11 sensor and the relay to switch on the Air conditioner. The DHT-11 gives the temperature reading up to 2oC accuracy. The temperature change is continuously sensed by Arduino and when temperature is above 27o C the AC is turned on and if below 23oC the AC is turned off. [3]

The entry counter is made by giving inputs provided by the IR sensors. These IR sensors are fed with the continuous IR radiation emitted by the IR LEDs, which when interrupted by the person entering or leaving the room makes Arduino count the entry or departure. The direction of the passage is determined by the order of interruption of IR signal i.e. the two IR sensors are continuously getting IR signal and if the first IR sensor gets interrupted and then the second then it counts +1 and if the case is reverse then it counts -1. And at the very same time the Arduino enables the capture buttonof The camera hence can capture the images of people entering and leaving the house [4].

The other sensors which include MQ-6 and MQ-135 just give the information about presence of flammable gas or smoke which triggers an alarm and a message is sent to owner about the unusual presence of flammable gas and smoke via GSM. The mishaps like fire broke out can be easily detected and a required action could be taken intime. Moreover the temperature also gives an idea if there is any such happening. The alarm is triggered if temperature exceeds 50oC and simultaneously an SMS is also sent about the temperature level [5].

IV. BLOCK DIAGRAM
V. IMPORTANCE AND USE OF GSM

GSM stands for Global System for Mobile Communication. The GSM module is a kit that provides the basic facility to connect to the mobile network by 2G technology with TDMA scheme. This module has capacity to send and receive calls and SMS along with the GPRS tracking.

In this project the GSM is used to provide security and to notify about certain events like fire etc. The GSM sends the SMS every time Arduino detects any flammable gas or smoke. Moreover it sends the SMS to the owner’s number when temperature is greater than 50°C. The main purpose of the GSM is to provide control of the system over a distance by authenticated users only mostly the family members. The set of numbers is already stored in the source code in Arduino which gets cross checked every time an SMS is received by GSM. This authentication can open doors to many new remote applications such. Here we are using it to turn system ON/OFF and to control certain features of the project.[6]

VI. RESULTS AND CONCLUSION

We have seen that enough work is done for IOT based home automation and there is greater scope for such technologies and research. Home automation is the trending need of every house owner. From the above paper, it is concluded that the system is integrated form of multiple automation units and indeed will be cheaper than getting separate systems for different purposes.

Here in this project we have used Arduino mega, GSM and various input/output devices. This project is a concept of integrating various devices to form a single package that comes with all the features required in home automation thus will prove beneficial to the developers and house owners. The main aim is to make the life style better by reducing burden of the owner of home and to provide the secure automation system with proper authentication of user/owner. The system has a brief monitoring system with instant notifying mechanism i.e. usingGSM

The results of the operation is based on the operations performed according to the inputs provided by the sensors. These sensors give inputs to Arduino mega which according to the particular case operates the other devices. These cases and their results are shown in table on next page. These results determine the efficiency, reliability and capacity of the prototype.
<table>
<thead>
<tr>
<th>Inputs and Cases</th>
<th>Results</th>
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<tbody>
<tr>
<td>1. If IR sensors 1 gets interrupted first and then sensor 2</td>
<td>The +1 count is stored in arduino memory as IR counter value.</td>
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<tr>
<td>2. If IR sensors 2 gets interrupted first and then sensor 1</td>
<td>The program decrements the counter value stored in memory.</td>
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<tr>
<td>3. If IR counter value is &quot;0&quot;</td>
<td>The lights and AC are off according to program.</td>
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<tr>
<td>4. If IR counter value is &quot;1&quot; or more</td>
<td>The lights and AC is turned on by default.</td>
</tr>
<tr>
<td>5. If PIR sensors are high (human present in room)</td>
<td>The lights associated with it turns on.</td>
</tr>
<tr>
<td>6. If PIR sensors are low (human not present in room)</td>
<td>The lights associated with the PIR sensor is turned OFF.</td>
</tr>
<tr>
<td>7. If temperature is below 23°C</td>
<td>The AC is not on or is turned off.</td>
</tr>
<tr>
<td>8. If temperature is above 27°C</td>
<td>The AC is turned ON.</td>
</tr>
<tr>
<td>9. If temperature is above 47°C</td>
<td>The GSM sends message to user about the temperature limit.</td>
</tr>
<tr>
<td>10. If MQ-6 (methane sensor) value is &quot;1&quot; and not &quot;0&quot;</td>
<td>The GSM sends an alert &quot;LPG leakage detected&quot;.</td>
</tr>
<tr>
<td>11. If the SMS received by the GSM is not valid</td>
<td>The authentication is not done and commands are not accepted.</td>
</tr>
<tr>
<td>12. If the SMS received by the GSM is invalid</td>
<td>The user is accepted and the SMS is used as command.</td>
</tr>
<tr>
<td>13. If the SMS is &quot;ON&quot; or &quot;OFF&quot;</td>
<td>If SMS is &quot;ON&quot; or &quot;OFF&quot;, system is turned on/off accordingly.</td>
</tr>
</tbody>
</table>

Fig 2 LCD displaying Heat, Temperature, CH4 concentration, CO2 concentration and counter value.

Fig 3 SMS received by user via GSM module.
Fig 4 Pin out diagram of automation system

V. REFERENCES


