

Automating Homes using Economic Embedded System

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Abstract

In a previous couple of years, innovation has developed at a rapid. Additionally, human lives have turned out to be more subject to electronic gadgets and machines. It has along these lines driven us to build up an automated home system. The prominence of automated homes has been expanding boundlessly lately because of substantially higher moderateness and effortlessness. Having the capacity to control parts of our homes, and for having the component to react consequently to occasions, it is winding up increasingly prevalent and essential because of security and cost purposes. This paper presents to execute a coordinated home automation system; proposing a minimal effort arrangement utilizing the off rack parts decrease price and open source programming to find rudimentary programming skills to empower any guileless client to work the machines. To show the practicality and adequacy of this system, gadgets such Arduino UNO which controls sensors and actuators that screen a characterized area and make a move in view of determined parameters like encompassing light, temperature and so on. The Arduino can likewise send alarms in the event that it distinguishes an irregularity. The project consists of 3 feedback channels/sensors and employs the use of PWM technique to vary the voltage levels of the LED and DC-motor.

Keywords: Home Automation, PWM technique, Micro Controller, LED, Arduino UNO, Sensors.

INTRODUCTION

In the present day, automation has turned out to be one of the famously appealing zones that assume an imperative part of everyday life [1]. Home Automation Systems (HAS) are quickly rising and getting the chance to be noticeable nowadays on the planet and its end customers are especially the crippled and elderly yet in light of their multifaceted nature and cost it isn't by and large recognized. Populace maturing is occurring in almost every one of the nations of the world. Maturing comes about because of diminishing mortality, and above all, declining richness. This system prompts a considerable diminishment in the level of kids and to an improvement in the offer of individuals in the critical working ages and of more settled people in the majority.

The worldwide populace matured 60 years or over numbered 962 million of every 2017, more than twice as extensive as in 1980 when there were 382 million more established people around the world. The quantity of more seasoned people is required to twofold again by 2050 when it is anticipated to achieve almost 2.1 billion [2].

Home energy utilization has a tendency to develop in the extent to increment of expansive estimated home apparatuses. Energy utilization must be enhanced to decrease carbon dioxide outflows [3]. In the course of the most recent ten years, numerous associations inside IT, Communication, Real Estate, and Home Appliances industry have been hoping to distinguish and profit by the guarantee of chances in data innovation at home. The

idea of home data shifts in various businesses. The last objectives of a home data framework are to give family different administrations and applications keeping in mind the end goal to make family life charming, agreeable, advantageous, and secure [4].

Home automation regularly characterizes a habitation that coordinates innovation and administrations through home systems administration to enhance the nature of living. Automated homes aren't another term for the science society and have been around for a fundamental time. Home automation meets, for the most part, concentrated control of lighting, temperature, contraptions, and differing structures, to give updated comfort, settlement, amplex, and security. For debilitated and elderly individual home computerization can be the substitute for an institutional thought.

SubhankarChattoraj [5] has presented the use of sensors like MQ5 the LPG sensor and temperature sensor, LM35 and the humidity sensor, DHT11 has also been interfaced with Arduino to enhance the safety feature of the HAS. Shepherd [6] has presented utilizing Bluetooth remote headway as an association substitution utilizing the remote interconnectivity which can be executed utilizing the radio home automation system strategy. Adriansyah, A. et al [7] delineated a framework prepared to screen and control lights, room temperature, alerts, and other household machines. Sriskanthan et al. [8] clarified automated system in view of Bluetooth remote innovation which enables the client to screen and control distinctive machines that are associated over a Bluetooth organize in light of a versatile host controller. Cubukcu, A. et al [9] has actualized discourse acknowledgment based remote control of home gadgets. Maqsood, J. [10] actualized strategies and gave a reasonable answer for acknowledging home automation

system which involves Bluetooth control by means of Android application improvement for in-house control and GSM (Global System for Mobile Communication) innovation for versatile control utilizing Arduino. Bader M. O. Althobaiti [11] paper demonstrates another method to automate home through a PC-Internet-Uno miniaturized scale controller based home automation framework. The proposed structure has two operational modes. The first is physically computerized mode and the second one is self-automated mode. The framework contains two major hardware parts: the PC home disjoins and the Arduino-UNO miniaturized scale controller board.

Concerning this project, the proposed arrangement is to build up an economical smart home framework without expanding the multifaceted nature and utilizing off the rack segments to lessen the cost and open source programming to get around authorizing prerequisites of programming.

The sensors will be controlled with the assistance of Arduino. Arduino is an open-source prototyping stage that gives simple to utilize equipment and programming conditions. It is moderately modest contrasted with other microcontroller-based stages like Raspberry Pi 3. Subsequently making a financial and vitality proficient framework improvement.

In the following part, we have portrayed the equipment setup of our system. We had portrayed the technique in Section III, while Section IV depicts the experimental evaluation and the conclusion is exhibited in Section V.

HARDWARE PLATFORM

The hardware part mainly comprises of an advanced PC, an Arduino UNO board, Infrared Sensor, Light Detecting Resistors, DC Motor, the Temperature sensor (LM35), Quadruple Half-H Driver

(L293D), which are being discussed alongside their particular capacities:

Arduino UNO

An Arduino board [12] comprises of an Atmel 8-, 16-bit or 32-bit AVR smaller

scale controller with integral segments which helps in programming and other circuit joining. This board has a 5-volt direct controller and a 16 MHz precious stone oscillator.

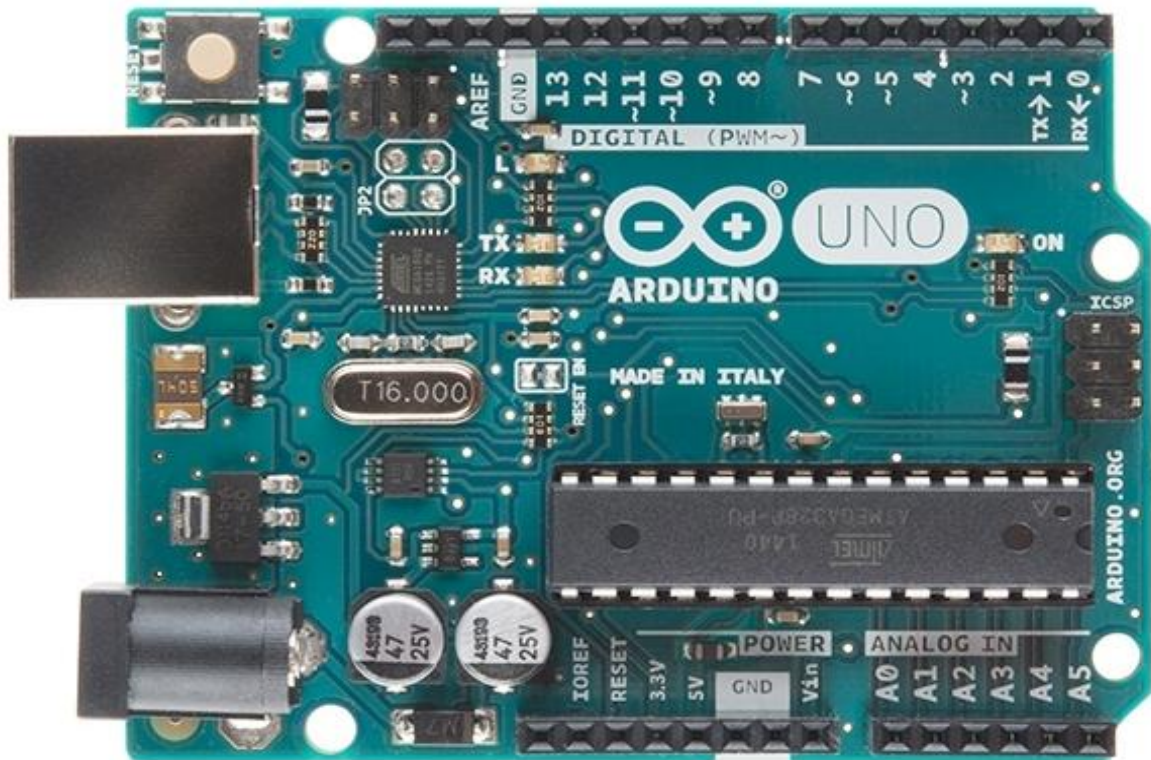


Figure 1: Arduino UNO

IR (Infra-red Sensor)

IR (INFRA-RED) sensor [13] relies upon LM 358 IC which is an Operational enhancer going about as a comparator. The comparator takes a gander at the straightforward voltages of the

potentiometer and the voltage made by the photodiode. The two voltages are associated on the two terminals of the IC and correspondingly it produces an advanced yield on the yield stick that is demonstrated by a Red Led.

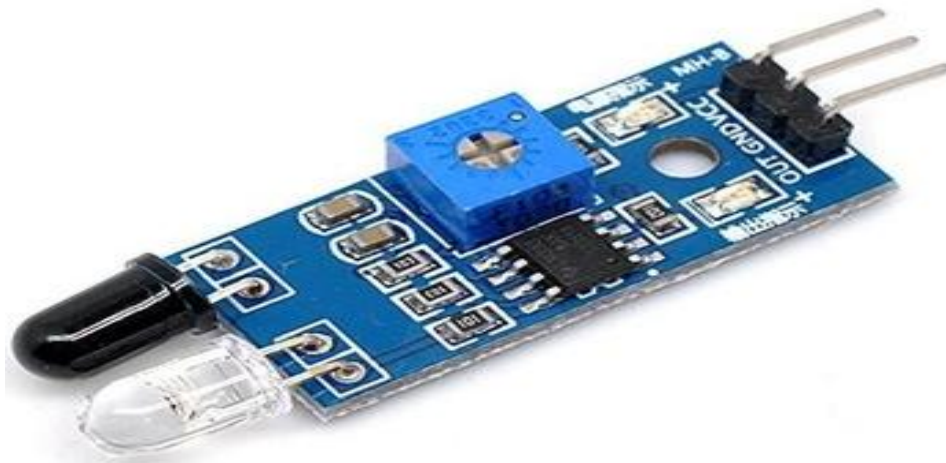


Figure 2: IR (Infra-red Sensor)

LRD (Light Detecting Resistors)

Light Detecting Resistors, are the extraordinary kind of resistor that have a (variable) protection that movements with

the light power that falls upon it. This enables them to be utilized as a part of light detecting circuits.

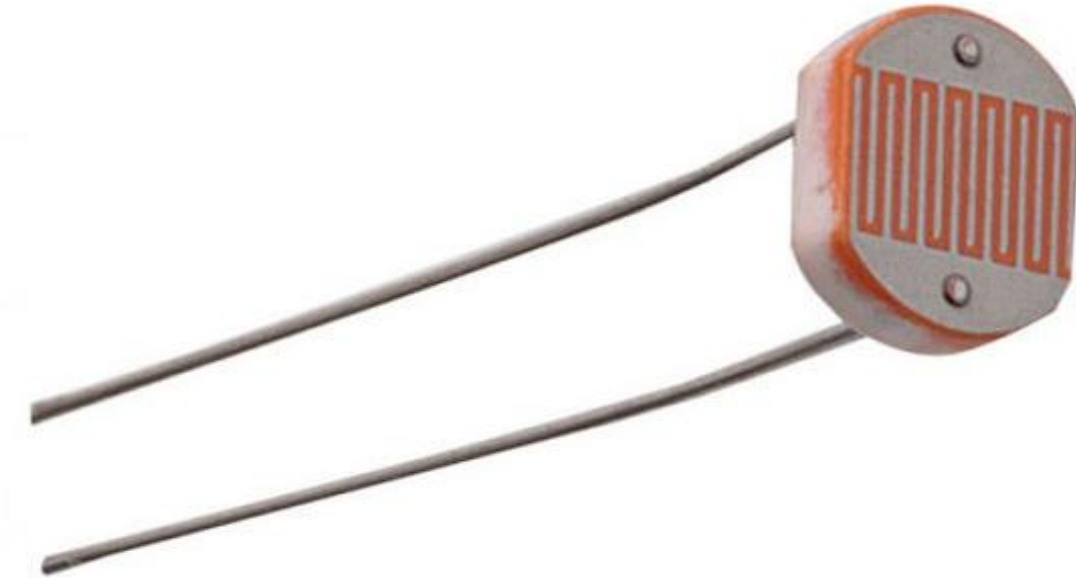


Figure 3: LRD (Light Detecting Resistors)

LM35 (Temperature Sensor)

LM35 is an exactness incorporated circuit temperature detecting gadget with a yield voltage directly corresponding to the temperature in centigrade. LM35 [14] device

has good position over direct temperature sensors adjusted in Kelvin, as the customer isn't required to subtract a considerable predictable voltage from respect gain worthwhile centigrade scaling.

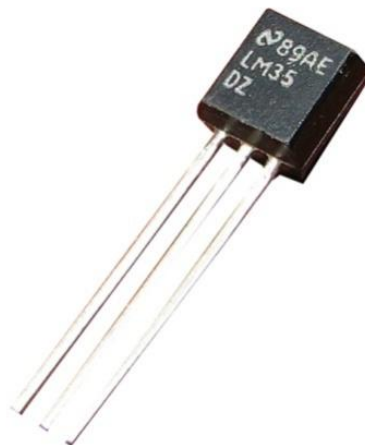


Figure 4: LM35 (Temperature Sensor)

L293D (Quadruple Half-H Driver)

L293D is a quadruple high current half-H driver. The L293D [15] is planned to give bi-directional drive surges of up to 600-mA at voltages from 4.5 V to 36 V and to

drive inductive burdens, for instance, exchanges, solenoids, DC and bipolar wandering motors, and furthermore other high-present/high-voltage stacks in positive-supply applications.

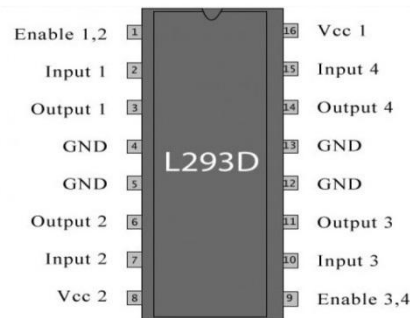


Figure 5: L293D (Quadruple Half-H Driver)

METHODOLOGY

The device consists of 3 feedback channels/sensors and employs the use of PWM technique to vary the voltage levels of the LED and motor. By doing so we are able to vary the brightness of LED and speed of DC-motor. The 3 sensors consist of:

- Infrared sensor used to detect human presence.
- LM35, this is the LM series of temperature sensor used to detect temperature in the surrounding environment (air).
- LDR (Light Dependent Resistor), this is a special type of resistor. It has the property to vary its resistance according to the surrounding environment's brightness level.

When the system detects human presence, i.e. the IR sensor gives high input on the digital pin of the Arduino then the motor and light are activated. The IR sensor works on the phenomenon of the distance, i.e. infrared waves are sent from the sensors and received after being reflected at some distance. The difference between the received and the transmitted voltage level of the signal determines the separation of the object from the sensor. The separation can be varied with an onboard potentiometer as per the requirement. Whenever a human being comes within the set distance from the IR sensor, it outputs a digital logic 1 on its

output pin which is received and detected by the Arduino.

The brightness level of the LED is inversely proportional to the intensity of the surrounding environment, i.e., as the brightness in the environment increases the brightness of the LED decreases proportionally. For this purpose LDR sensor has been employed in which we have taken voltage divider topology in our circuit to map the resistance changes in the LDR with respect to the changes in the brightness level of the environment.

The speed of fan must differ as per the temperature estimation of the surrounding environment; an expansion in temperature must incite the framework to build the speed of the fan, this is accomplished by the utilization of LM series of the temperature sensor (LM35). The motor's speed increases in coherence with the increase in the temperature sensor's output values.

There are many ways of varying motor's speed, one being the use of H-bridge BJT, as employed in the L293D series of IC's for motor driver applications. We have also used an L293D IC based motor driver circuit, by putting a PWM signal into the input pin of the IC and thus varying the motor's speed. As mentioned in the previous paragraph, when a lower temperature is detected we decrease the voltage level of the PWM signal and vice-versa.

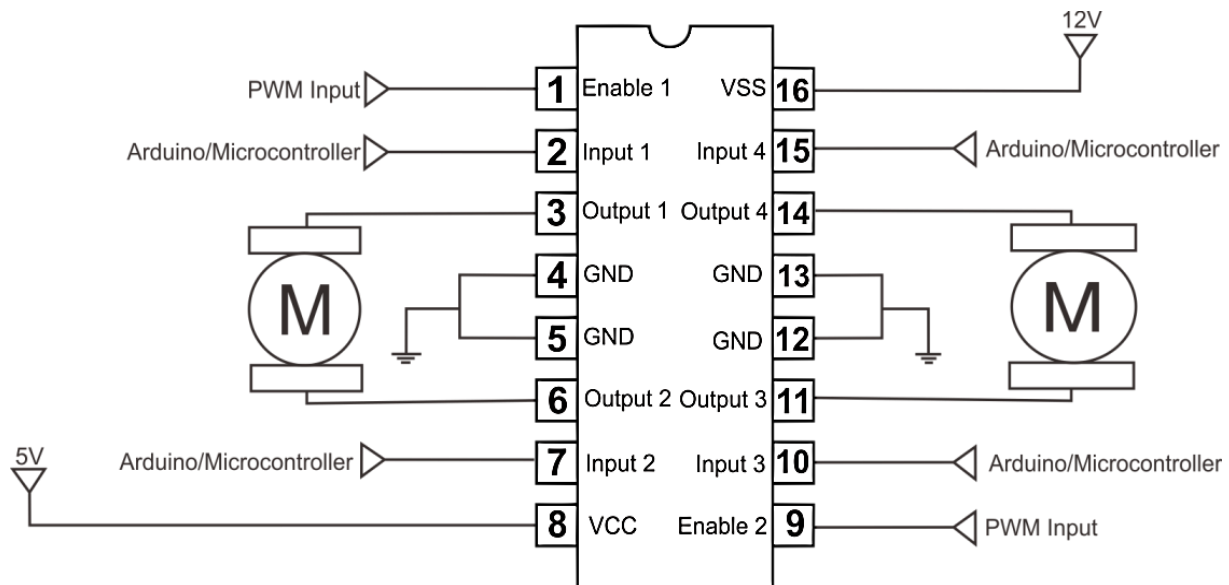


Figure 6: (IC) Pin Diagram

PWM (Pulse-Width Modulation)

Signals: A Pulse Width Modulation (PWM) Signal is a strategy for creating an analog signal utilizing a digital source. A PWM signal comprises two principal segments that characterize its conduct: a duty cycle and a frequency. The duty cycle depicts the measure of time the signal is in a high (on) state as a level of its aggregate

time takes to finish one cycle. The frequency decides how quick the PWM finishes a cycle, and consequently how quick it switches amongst high and low states. By cycling a digital signal now and again at a sufficiently quick rate, and with a specific duty cycle, the output will seem to carry on like a consistent voltage analog signal while giving power to devices.

50% duty cycle



75% duty cycle



25% duty cycle



Figure 7: PWM Signals Texts and Image (Graph)

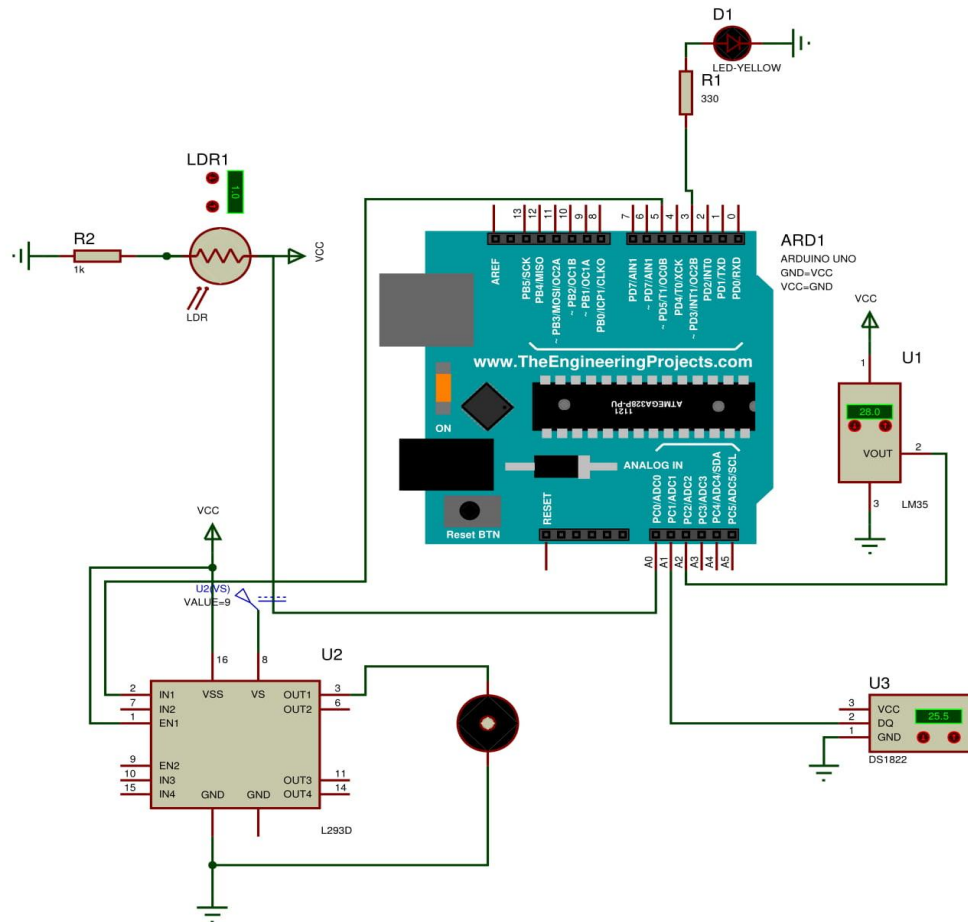


Figure 8: Circuit Diagram (Block Diagram)

EXPERIMENTAL EVALUATION

Remembering the true objective to execute and show the system grew hypothetically, we made a model that speaks to various

home machines. In this way, the entire framework that is being produced is given underneath

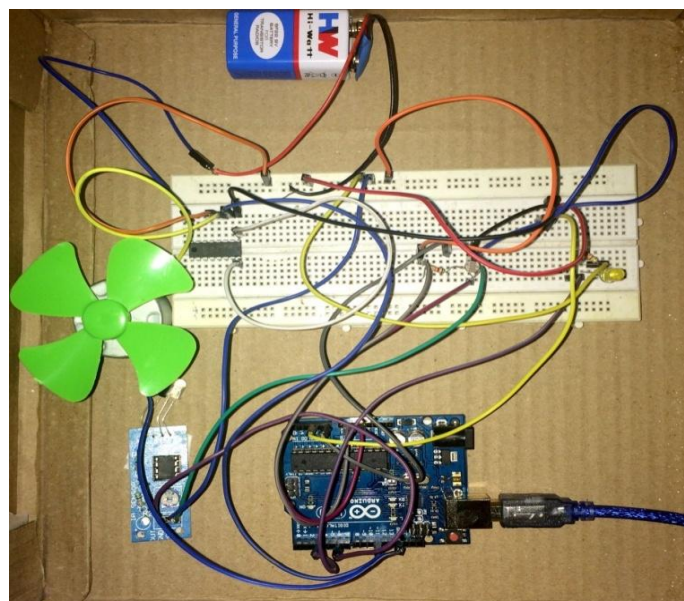


Figure 9: Complete Circuit

From this figure given here we can see particular parts of the circuit board that is delivered, or, in other words, the Arduino's progressed and basic sticks as required.

CONCLUSION

A novel engineering for an economical smart home system is proposed and executed in this paper. It gives a fundamental idea of how to control diverse home apparatuses. The expense of smart homes advancement is for a couple of individuals a dispute against the choice of such foundations. These projects uses dial down the rack parts and rely upon Arduino organize which is FOSS (Free Open Source Software). So the general use cost is exceptionally shoddy and reasonable by a typical individual. This simple framework is planned to upgrade the standard living in a home. A gear usage of the system was finished to check the unwavering quality of the system. The executed framework was a straightforward, minimal effort and adaptable that can be extended and scaled up.

For future work in the field of the home automation system, we will consider a home automation framework overall and create conduct expectation and propelled detecting parameters that can distinguish and forestall gifted and modern interlopers. Security is indispensable for the best possible execution and advancement of the home mechanization frameworks. Besides, it gives a suspicion that all is well and good to a home's occupants and comforts their brains. An execution of RFID framework for affirming the personality of proprietor can be utilized as an additional component for security as methods for affirming character. Carports can be opened consequently. Lights can be killed notwithstanding amid light if proprietor completing RFID tag goes. It will likewise consequently turn on light when he re-goes

into the house. The voice control framework can be executed with precision in voice acknowledgment and better pitching examination. More gadgets can be reenacted and clock could be set for the programmed task. All the future work can be actualized on a similar framework by changing the application in the Android gadget.

The entire framework can be manufactured as an economic business equipment bundle. The possibility of this home automation can in like manner be used for network automation in smart grids in power systems.

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