An Innovative Approach for a Smart Home

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Abstract

People crave for successful aging, without any dependency on others and this requires taking care of an individual's physical, mental and social health. In order to facilitate the elderly to maintain their capacity to carry out the daily activities of life, advances in smart home technologies are initiated. These technologies provide an embedded assessment of an individual's functional ability in his/her home on a moment-to-moment, daily, and longitudinal basis. The disabled people can benefit the most from this technology as they encounter huge difficulties to even perform the basic activities of daily life. The target of smart home systems is to create an environment that is aware of the activities taking place within it. Smart homes are no longer design concepts of the future. They are being built now, and they are having a direct impact on the lifestyles of people living in them.

Keywords: Arduino, LED, sound sensor, photo resistor.

I. INTRODUCTION

By 2050 India will be home to one out of every six of the world's older persons, and only china will have a large number of elderly people. Smart home technology refers to houses installed with monitoring systems (sensors, actuators, and biomedical monitors) and special wiring to enable the appliances to work on its own making decision through some predefined programs. Smart homes have been defined as the integration of technology and services through home networking for a better quality of life. Monitoring devices, such as sensors, are small and can be installed anywhere—inside or outside the home, or worn by an individual.

Depending on the user's needs, a smart house can include a basic network of wires operated by a central control panel in the home, while it also allows the user to operate the appliances and features remotely from any area of the house. Home automation provides relative ease of use. Much of the work is carried out by the system itself, where it detects activity and discerns information based on home owner input. The key goal for home automation is to give the occupant total control over the house from anywhere in the house or even without manual input.

This emphasizes that the home environment should be able to respond and modify itself continuously according to diverse and changeable needs. This is considered to be a first step towards creating a sensitive, adaptive and responsive home environment.

The use of modern technology is adding to a safe and comfortable living environment for everybody. For the disabled person, the benefits are even greater. Smart home technology has proved to contribute to increased independence and safety for lots of end-users, their families and the people who care for them. Smart home technology may be used to minimize disabling obstacles. Smart home technology is becoming increasingly more common to ordinary consumers, and the owner of many new building projects are proud to announce it, if the flats are fitted with "new, intelligent technology". There is a responsibility resting on governmental bodies and professionals to involve in the future planning of community care, to ensure that technology are used to assist the human helpers that always will be the basis in all care.

II. DESCRIPTION

This work aims at automating the lighting and fan of a home. The electronic gadget that is used here is an Arduino. It is a microcontroller based on easy to use hardware and software.

A. Automatic Light

As soon as a person enters the room, the lights in the particular room are automatically switched on. The system counts the number of people that goes in and out of the room and the light is automatically switched off only when the room is completely empty. This is done with the help of two proximity sensors which makes the counting accurate.

B. Automatic Fan

The fan is automatically turned ON/OFF with the sound of a CLAP or anything as such within its suitable range. This is achieved by using a sound sensor and fixed at a suitable range.

C. Automatic Podium Light

Needs no manual operation for switching ON and OFF. When there is a need of light it automatically switches ON. When darkness rises to a certain level then sensor circuit gets activated and switches ON and when there is other source of light i.e. daytime, the street light gets OFF. The

sensitiveness of the street light can also be adjusted. In our project we have used LED as a symbol of street lamp, but for high power switching one can connect Relay (electromagnetic switch) at the output of pin 3 of atmega328 that will make easy to turn ON/OFF any electrical appliances that are connected through relay.

D. Automatic Fire Alarm

An automatic fire alaram system is designed to detect the unwanted presence of fire by monitoring environmental changes assosiated with conmbustion. There is temparature sensor which records the tempratue of the target room all the time and as the temprature rises above some particular level the alarm is switched on to summon emergency services, and to prepare the structure and system assosiated systems to control the spread of fire.
The microcontroller takes the input fron the sensor and switches the alarm on after a particulr level of temprature.

III. DETAILS OF CIRCUIT DIAGRAMS, HARDWARE DESCRIPTION, COMPONENT, SELECTION AMD IMPLEMENTATION

For this work we have used Arduino UNO an open source combination of hardware and software, 2 IR sensors and a sound sensor.

A. Arduino Uno

Arduino is a microcontroller interface built around an Atmel ATmega processor, coupled with a language and programming environment for creating logic on the chip. Arduino allows users a simple pathway to create interactive objects that can take input from switches and sensors, and control physical outputs like lights, motors or actuators. Because the language is based on well-used frameworks, advanced programming on Arduino if done can be used to develop an interface with which we can interact with other software on the computer.

Table I

Microcontroller	ATmega328
Operating Voltage	5V
Input Voltage (recommended)	6-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
Analog Input Pins	6
DC Current per I/O Pin	40 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	8 KB (ATmega8)
SRAM	1 KB (ATmega8)
EEPROM	512 bytes (ATmega8)
Clock Speed	8 - 16 MHz

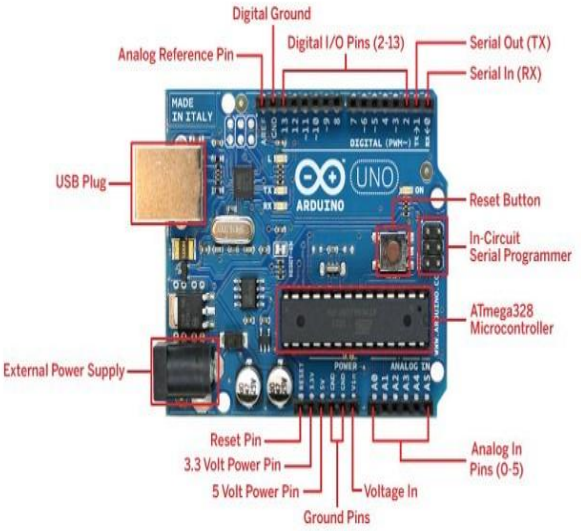

Figure 1: Arduino UNO

B. Infra Red (IR) Sensors

R_1 is to prevent the emitter (clear) LED from melting itself from overheating by drawing excessive current. Look at the emitter spec sheet to find maximum power intake of your LED. The value of R_1 should be , Vcc^2/R_1 < Power specification. We will put R_1 = 100ohms as it suits the LED's we are using R_2 should be larger than the maximum resistance of the detector. Measure the resistance of the detector (black) when it is pointing into a dark area and then choose the next larger resistor. This means V_{out} is close to maximum when there is no signal. We will use a 30kohm variable resistor here in series with a 100ohm resistor for calibration.

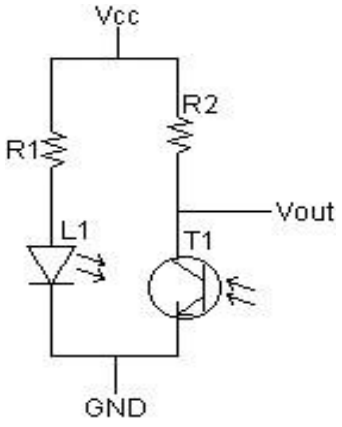

Figure 2 Circuit Diagram of Infrared Sensor

C. Sound Sensor

Based on a similar concept as the IR sensor, but the IR sender is replaced by the sound we give, the IR receiver is replaced by the microphone. The

sound detected by the microphone can be adjusted varying the variable resistor.

The microphone converts the sound into electrical signal and provides it to the Op amp to magnify, if the level of electrical signals generated is above the threshold value of the op Amp then the Op amp would magnify the difference and supply a 5V output from the output pin of the Op amp.

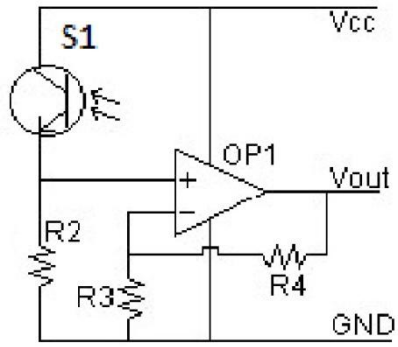

Figure 3: Circuit Diagram of Sound Sensor

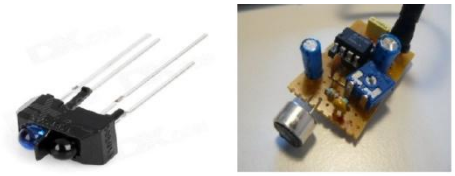

Figure 4: IR Sensor and Sound Sensor

D. Photoresistor

A photo resistor or light-dependent resistor (LDR) or photocell is a light-controlled variable resistor. The resistance of a photo resistor decreases with increasing incident light intensity; in other words, it exhibits photoconductivity. Ambient light falling on the photo resistor causes the streetlight to turn off. Thus energy is saved by ensuring the light is only on during hours of darkness.

Figure 5: Photo-Resistor

E. LM35 (Temperature Sensor)

The LM35 series are precision integrated-circuit temperature devices with an output voltage linearly-proportional to the Centigrade temperature. The LM35 device has an advantage over linear temperature sensors calibrated in Kelvin, as the user is not required to subtract a large constant voltage from the output to obtain convenient Centigrade scaling. The features of the sensor can be summed up as:

- Calibrated Directly in Celsius (Centigrade)
- Linear + 10-mV/°C Scale Factor
- 0.5°C Ensured Accuracy (at 25°C)
- Rated for Full −55°C to 150°C Range
- Suitable for Remote Applications
- Low-Cost Due to Wafer-Level Trimming
- Operates from 4 V to 30 V
- Less than 60-µA Current Drain
- Low Self-Heating, 0.08°C in Still Air
- Non-Linearity Only ±¼°C Typical
- Low-Impedance Output, 0.1 Ω for 1-mA Load

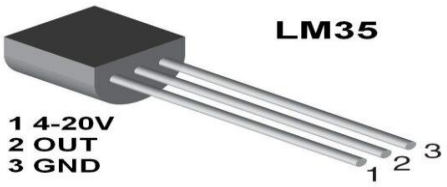

Figure 6: LM 35

IV. MERITS & DEMERITS

A. Merits

- Sensors used have high sensitivity and are easy to handle.
- Advanced technology in the area of home security has provided a convenient and safe way to keep homes and family members out of danger.
- It is more cost-effective for older adults and persons with disabilities to remain living at home for as long as possible, with assistive, supportive, and health-monitoring devices, than to be placed in healthcare institutions. One study (Chan, et al., 2008)5 revealed that 46 per cent of "on-site nursing activities" could be replaced by technology that can supervise health status from afar.
- Smart-based technology, integrated into the home environment, supports the ability of older adults and people with disabilities to continue living safely in their own homes for longer periods of time.
- Such technology increases a user's ability to be self-managing for longer periods of time—promoting feelings of competency and reducing vulnerability to depression.
- Low cost system, providing maximum automation.

- Feedback for every command is given by system.
- Advancements in technology, together with increasing knowledge of and experience with computers and computerized devices by the general public of all ages, has made smart home technology much easier to use and to adapt to daily routines.
- Smart home technology is especially attractive for use in rural areas, where lack of proximity to health care could compromise medical conditions.

B. Demerits

- The practical design of smart home technology is extremely important for older adults and individuals with disabilities. If devices are prone to system failures (similar to those encountered on a personal computer—such as unresponsive networks or software malfunction), complex actions to fix the situation (i.e., resetting the entire system) may prove too inconvenient or even dangerous for the user.
- Devices that assume prior computer skills or devices that are not tailored to individual needs could also prove problematic. For example, for people who are vision- or hearing-impaired, certain technologies are ineffective, such those that require video monitoring or being attentive to auditory signals.
- These technologies also present issues for cognitively impaired individuals who might find a control panel or remote control device difficult to use.
- If the microcontroller fails, the whole system will be compromised.
- Issues of privacy often surface as a major concern in smart house development. Much of the technology being devised for older adults and people with disabilities involves an element of monitoring by others that some people find obtrusive. Cameras and surveillance devices are a concern for many who value privacy. Therefore, it is important that informed consent be obtained before installing technology that could create discomfort. Developing a code of conduct for healthcare providers who monitor individuals could further prevent a compromise of privacy.

V. CONCLUSION AND FUTURE WORK

This work was inspired from the problems that disabled people encounter in their everyday life while most of other people do not aware of their difficulties. One of the biggest needs required for disabled people is to continue their daily life activities when they are alone at home and there is nobody to help them.

There are many studies about smart houses but we observed that there is not enough smart home system aims to help disabled people. We added a new aspect to smart home systems by aiming to help disabled people.

Even though we implemented this system for disabled people, it can be used by healthy people. Because this system aims to make easy of people's daily life at home.

Actually disabled people encounter with more problems than mentioned in this work. For the future work, the actuation scenarios for disabled people can be increased and improved.

ACKNOWLEDGEMENT

"Perseverance, inspiration and motivation have always played a key role in any venture. It's just not the brain that matters most, but that which guides them. What was conceived just as an idea, materialized slowly into concrete facts? The metamorphosis took endless hours of toil, had its moment of frustration but in the end everything seemed to have sense."

At this level of understanding it is often difficult to understand the wide spectrum of knowledge without proper guidance and advice. Hence we take this opportunity to express our heartfelt gratitude to our project guide Professor Prajit Paul who had faith in us and allowed us to work in this field.

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