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SMART EQUIPMENT ARCHITECTURE FOR DISABLED PEOPLE

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ABSTRACT:
Nowadays, home appliances manufacturers are increasingly relying on wireless sensor network and single chip embedded technologies to build smart environment. Many existing systems are already in the market, however, they were designed without envisioning the need of residents with special needs. This work presents a framework that enables the integration and control of devices within a smart home environment for residents with disabilities. The framework supports the integration of multiple control devices for different residents with different disabilities. Moreover, the work addresses the safety of the users by providing warnings and notifications in case of an emergency. A prototype was designed, implemented and tested. Further, this concept is enhanced by using Internet of Things for efficient design.

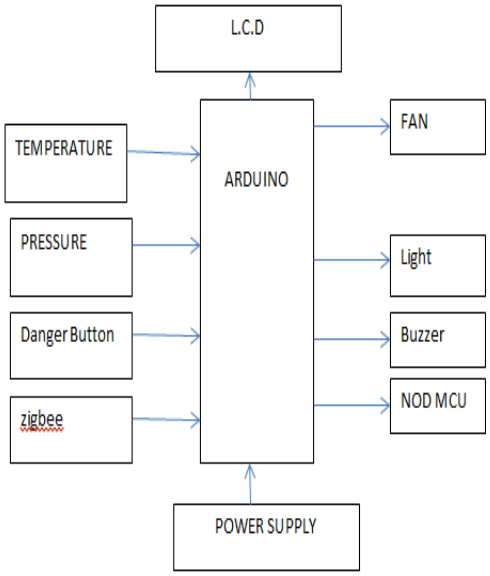
INTRODUCION: Smart grid communications are based on wireless and wired networks technologies. Regardless of the technology, these networks can be classified based on their functionality within the smart grid. This classification as reported in the literature are: home area network, neighborhood area network, access network, backhaul network, core and external network [1]. These networks connect many smart grid objects such as home appliances, smart meters, switches, reclosers, capacitors bank, integrated electronic devices (IEDs), transformer, relays, actuators, access points, concentrators, routers, computers, printers, scanners, cameras, field testing devices, and the list can go on to many devices. This work proposes a framework for homes to enable people with different types of disabilities the control of appliances and devices within their home environment. Home Area Networks (HAN) are implemented and operated within houses or other small boundary offices to enable communication between user's peripheral devices to various home appliances. Such appliances are: televisions, air conditioning systems, security systems, and other devices like fax, printers, as well as small network attached storages. Moreover, HAN technology allows the user to control and monitor many digital devices throughout the house. The basic HAN includes devices such as, an access point, the home appliance(s), and a smart meter. The HAN's access point has network switch services that provide users with wired LAN ports or wireless connectivity being developed in various fields such as homes and hospitals. WSN consists of a large number of wireless sensor devices working together to achieve a common objective. A wireless sensor device is a battery-operated device that has the capability of sensing physical quantities [2], provides efficient wireless communication and data storage. Moreover, a WSN has one or more base-stations that gather information all the sensor devices. The base stations provide an interface through which the WSN interacts with the outside world [2]. This work designs and implements a wireless sensor nework inside a house that provide users with special needs essential and basic control within a home environment. The proposed work enables the user to perform his/her daily activities by remotely monitoring and controlling home appliances without depending on others. The input and output are automatically adjusted depending on the user's special needs and environment. The smart home area network (HAN) technology offers users a wide range of services. Users that integrate HANs into their homes can monitor and/or control their appliances remotely and within the house using smart phones or control panels. However, most of the monitoring and control system in the HAN technology are not feasible to people with disabilities such as visually impaired, deaf, and handicapped. A blind person cannot see whether the window is open/close, similarly a deaf person cannot hear the fire alarm. A handicapped person (with hand disability) one the other hand cannot use his/her phone to check if the refrigerator

door is open or closed. Hence, most of the existing HAN technologies are aimed at healthy people. Other specialized devices are developed; however, the devices operate only based on one specific disability. Home appliance control systems (HACS) are not a new concept. They have existed in science fiction but also in implementation. X10 was the first such system and was created in 1975. Although it and other HACS have been available for over 30 years, they have not seen widespread adoption and remain only as a subject of science fiction to the general community. It is believed that the lack of adoption is due to the lack of extensibility, cost, and ease of existing systems. The Home Appliance Control System (HACS) is developed to control various home appliances such as a Microwave, Oven, Air Conditioner, TV, etc., through one or more controllers such as a cell phone or PDA. In centralized controlled systems, home appliances will be connected to base station, which is called the Home Appliance Controller (HAC), installed in the house. Through HAC we can control all the home appliances by issuing commands from the mobile device. If the control is distributed home appliances will not be connected to base station, rather any appliance will be able to take control over other appliances. HACS will give us easy control over the home appliances even when we are away.

LITERATURE SURVEY:

The introduction of home automation in the 1970s failed to improve the lifestyles of users for several reasons. Firstly, determining economic benefits of home automation technologies is difficult. The costs of implementing smart home technology must be justified by the effects brought about by their installation [3]. There is a need for home automation technologies to be cost effective, easy to install and flexible with many network infrastructures and appliances. In 2003, Housing Learning & Improvement network published a smart home definition offered by Interetec which states that a smart home is "a dwelling incorporating a communications network that connects the key electrical appliances and services, and allows them to be remotely controlled, monitored or accessed" [4]. The following section includes a brief summary of previous research into smart homes within the past decade. In 1995, Welfare Techno-Houses were constructed in Japan. [7]. The purpose of these experiments was to provide health monitoring for elderly and disabled persons at home by using fully automated measurements to support daily health care and improve quality of life. The University of Texas at Arlington has conducted the MavHome project over the past 7 years [8]. The MavHome (Managing an Adaptive Versatile Home) is a home environment that detects environment states through sensors and intelligently acts upon the environment though controllers. The sensors in the home form an ad-hoc network with interconnect together to make appropriate decisions. SAP laboratories in Canada with researches from the University of McGill [6] present a wireless solution for monitoring people in need of medical assistance. The application relies on the use of cell phones and inexpensive sensors and is best suited for the elderly and home-bound people. The main functions of the project is to collect signals through a wireless sensor network using protocols like ZigBee and Bluetooth and the analysis for data through an adaptive architecture that produces real-time heath-monitoring system to improve medical support for people in their homes and in assisted living environments. The research highlights a general architecture framework that consists of three major parts. Firstly, medical data is collected from sensors and transmitted to mobile devices through a wireless sensor network. Secondly, collected data is processed by a J2ME application running on mobile devices. Finally, the data collected and combined with data from other sensors to decide on an appropriate action. The advantages of this approach are that it does not require costly equipment, specialized infrastructure or a challenging learning curve. It can be deployed in a short period of time at a very low cost. Several groups have done extensive research into the use of smart home devices for the support or elderly and handicap people. The University of Erlangen-Nuremberg, Germany [5] has described the challenges regarding smart homes, especially for supporting the elderly and handicapped.

PROPOSED TECHNIQUE:



INTERNET OF THINGS:

IoT (Internet of Things) is an advanced automation and analytics system which exploits networking, sensing, big data, and artificial intelligence technology to deliver complete systems for a product or service. These systems allow greater transparency, control, and performance when applied to any industry or system. IoT systems have applications across industries through their unique flexibility and ability to be suitable in any environment. They enhance data collection, automation, operations, and much more through smart devices and powerful enabling technology.

ARDUINO UNO:

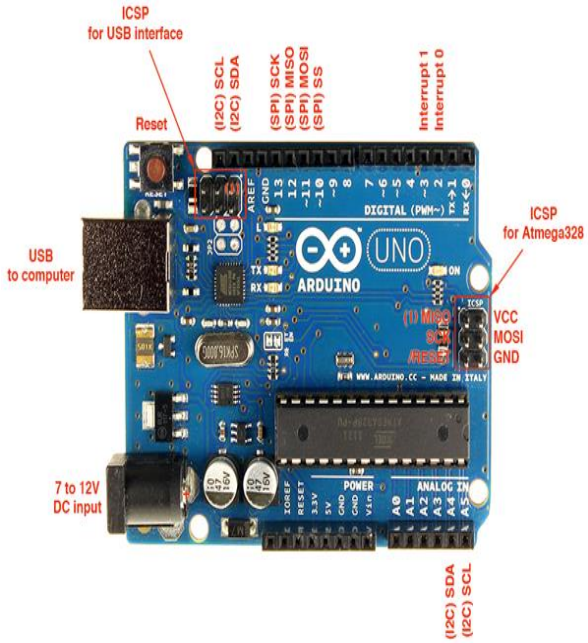
The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter. The Uno board has a resistor pulling the 8U2 HWB line to ground, making it easier to put into DFU mode.

The board has the following new features:

- 1.0 pinout: added SDA and SCL pins that are near to the AREF pin and two other new pins placed near to the RESET pin, the IOREF that allow the shields to adapt to the voltage provided from the board. In future, shields will be compatible with both the board that uses the AVR, which operates with 5V and with the Arduino Due that operates with 3.3V. The second one is a not connected pin, that is reserved for future purposes.
- Stronger RESET circuit.
- Atmega 16U2 replace the 8U2.

"Uno" means one in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version 1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards.

ARDUINO PIN DIAGRAM:



LIQUID CRYSTAL DISPLAY:_ The LCD is used for the purpose of displaying the words which we are given in the program code. This code will be executed on microcontroller chip. By following the instructions in code the LCD display the related words. Fig. shows the LCD display.

Introduction

Fig. : LCD Display

The LCD display consists of two lines, 20 characters per line that is interfaced with the PIC16F73.The protocol (handshaking) for the display is as shown in Fig. The display contains two internal byte-wide registers, one for commands (RS=0) and the second for characters to be displayed (RS=1). It also contains a user-programmed RAM area (the character RAM) that can be programmed to generate any desired

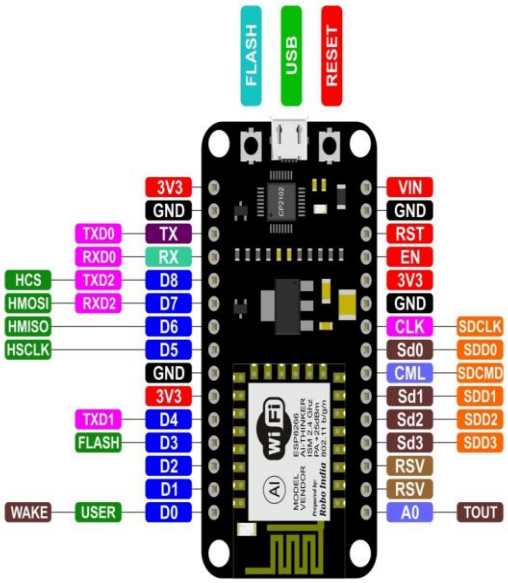
character that can be formed using a dot matrix. To distinguish between these two data areas, the hex command byte 80 will be used to signify that the display RAM address 00h will be chosen Port1 is used to furnish the command or data type, and ports 3.2 to 3.4 furnish register select and read/write levels.

THEORY:

A liquid crystal is a material (normally organic for LCDs) that will flow like a liquid but whose molecular structure has some properties normally associated with solids. The Liquid Crystal Display (LCD) is a low power device. The power requirement is typically in the order of microwatts for the LCD. However, an LCD requires an external or internal light source. It is limited to a temperature range of about 0°C to 60°C and lifetime is an area of concern, because LCDs can chemically degrade.

NODE MCU:

The Node MCU is an open source firmware and development kit that helps you to prototype your IoT product with ArduinoIDE or in few Lau script lines. It includes firmware which runs on the ESP8266 Wi-Fi SoC. And hardware which is based on the ESP-12 module. In this tutorial we explain how to use NodeMCU with Arduino IDE.

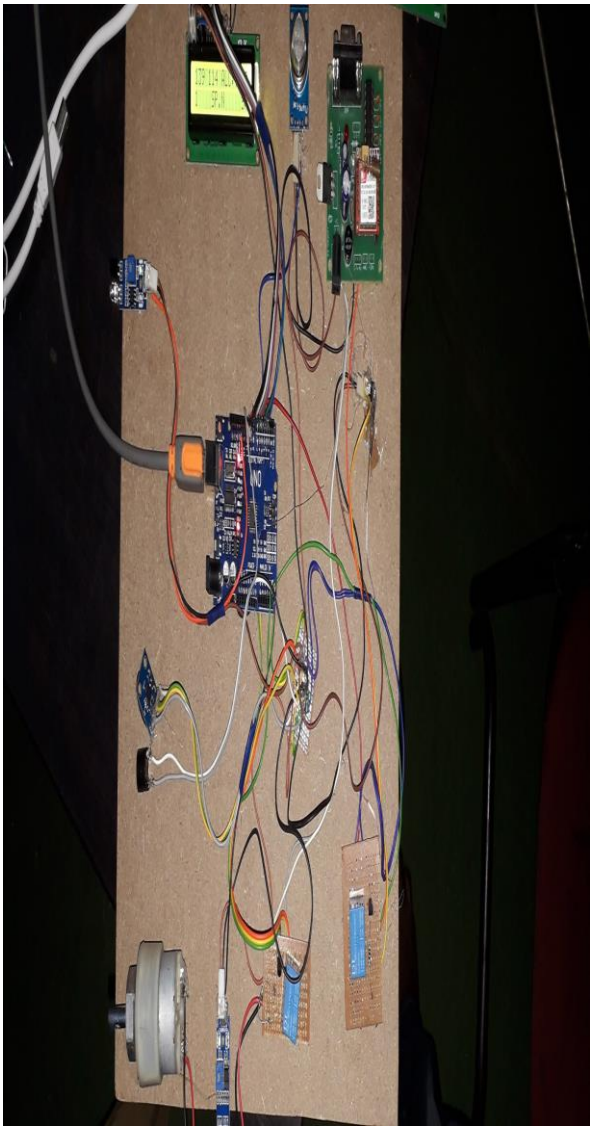


POWER SUPPLY

Block diagram

The ac voltage, typically 220V rms, is connected to a transformer, which steps that ac voltage down to the level of the desired dc output. A diode rectifier then provides a full-wave rectified voltage that is initially filtered by a simple capacitor filter to produce a dc voltage. This resulting dc voltage usually has some ripple or ac voltage variation. A regulator circuit removes the ripples and also remains the same dc value even if the input dc voltage varies, or the load connected to the output dc voltage changes. This voltage regulation is usually obtained using one of the popular voltage regulator IC units. The potential transformer will step down the power supply voltage (0-230V) to (0-6V) level. Then the secondary of the potential transformer will be connected to the precision rectifier, which is constructed with the help of op–amp. The advantages of using precision rectifier are it will give peak voltage output as DC, rest of the circuits will give only RMS output.

RESULT:



CONCLUSION:

Most of the existing smart home monitoring and control systems do not accommodate special needy users to manage their home appliances. A wireless sensor network based system for smart home automation was designed, built and tested to address such missing functionality. The implemented system's major contribution is that it is customized to provide the special need residents with tools and services to monitor and operate home appliances remotely. The implemented system provides home residents with disabilities to take advantage of the advancement in technology. It enables them to perform their daily activities by remotely monitoring and controlling their home appliances without having to depend on others. The system is programmed so that it can be configured to adjust to the customer's disability providing them with better and convenient lifestyle. It is worth mentioning that the system is scalable and can be extended to include more and different services and tools. The system is portable, compact, affordable and easy to use.

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