Design and Construction of IOT Based Air and Sound Pollution Monitoring System.



SONARGAON UNIVERSITY (SU)

Supervised By

Md. Rakibul Alam

Assistant Professor

Department of EEE

Sonargaon University (SU)

Submitted By

Md. Al Amin EEE-1902017052

Md. Mubin Talukder EEE-1902017095

Md. Azizul Islam EEE-1902017082

Md. Ahsan Habib EEE-1902017037

Department of Electrical & Electronic Engineering (EEE)
Sonargaon University (SU)
147/I, Panthapath,
Dhaka-1215, Bangladesh

Date of Submission: January 2023

Declaration

It is declared hereby that this thesis paper or any part of it has not been submitted to anywhere else for the award of any degree.

.....	….....
Md. Al Amin	**Md. Mubin Talukder**
.....	….....
Md. Azizul Islam	**Md.Ahsan Habib**

Under Supervision of

.....

Md. Rakibul Alam

Assistant Professor

Department of EEE

Sonargaon University (SU)

Certification

This is to certify that this project entitled "**Design and Construction of IOT Based Air and Sound Pollution Monitoring System**" is done by the following students under my direct supervision. This project work has been carried out by them in the laboratories of the Department of Electrical and Electronic Engineering under the Faculty of Engineering, Sonargaon University (SU) in partial fulfillment of the requirements for the degree of Bachelor of Science in Electrical and Electronic Engineering.

Supervisor

.....

Md. Rakibul Alam

Assistant Professor

Department of Electrical and Electronic Engineer (EEE)

Sonargaon University (SU)

ACKNOWLEDGEMENT

The report titled as on " **Design and Construction of IOT Based Air and Sound Pollution Monitoring System**" has been prepared to fulfill the requirement of our practicum program. In the process of doing and preparing our practicum report, we would like to pay our gratitude to some persons for their enormous help and vast co-operation.

At first, we would like to show our gratitude to the University authority to permit us to do our practicum. Specially, we would like to thank to our honorable teacher **Md. Rakibul Alam,** Assistant Professor, Department of Electrical & Electronics Engineering, SU– Sonargaon University, Dhaka, for his valuable and patient advice, sympathetic assistance, co-operation, contribution of new idea. Deep theoretical and hardware knowledge & keen interest of our supervisor in this field influenced us to carry out this project. His endless patience, scholarly guidance, continual encouragement, constant and energetic supervision, constructive criticism, valuable advice, reading many inferior draft and correcting them at all stage have made it possible to complete this project.

Finally, we would like to thanks again to the respected **Vice- Chancellor of SU, Professor Dr. Md. Abul Bashar** also thanks to **Head of Department of SU , Electrical & Electronics Engineering, Professor Dr. M. Bashir Uddin** because they are designated such an environment for learning through which we got the opportunity to acquire knowledge under Bsc in EEE program, and that will be very helpful for our prospective career.

We are, indeed, grateful to all those from whom we got sincere cooperation and help for the preparation of this report

Abstract

The main objective of IOT Air & Sound Monitoring System is that the Air and sound pollution is a growing issue these days. It is necessary to monitor air quality and keep it under control for a better future and healthy living for all. Here we propose an air quality as well as sound pollution monitoring system that allows us to monitor air quality as well as sound pollution in an area through IOT. System uses air sensors to sense presence of harmful gases in the air and constantly transmit this data. This system allows authorities to monitor air pollution in areas and act against it. Also, authorities can keep a watch on the noise pollution near schools, hospitals and no honking areas, and if system detects air quality and noise issues it alerts authorities so they can take measures to control the issue. to control the issue. The Air and Sound Pollution Monitoring System consists of the Arduino Uno which is based on ATmega328 microcontroller. Arduino is also known as the mind of the device as everything in this system is controlled by the Arduino. Initially, the Arduino is provided with a 5 V DC supply through port 9600.Network Devices and the Internet of Things All kinds of ordinary household gadgets can be modified to work in an IoT system. Wi-Fi network adapters can be embedded in these devices to enable them for work in the Internet of Things.

Table of Contents

Declaration ii

Certificate iii

Acknowledgement iv

Abstract v

List of Contents vi

List of Figures ix

List of Tables x

LIST OF ABBREVIATIONS xi

Chapter 1 Introduction page no.

1.1 Introduction 1

1.2 Executive Summary 2

1.3 Background 3

1.4 Objectives 5

1.5 Methodology 5

Chapter 2 Block and Circuit Diagram

2.1 Block Diagram 6

2.2 Circuit Diagram 6

2.3 Working Principle 7

2.4 Problem Statement 8

2.5 Required Components 8

2.6 Internet of things 9

2.7 Internet of things applications 9

Chapter Three Components Of This Project

3.1 Definition of Arduino 11

3.2 History of Arduino 12

3.3 Introduction of Arduino 14

3.4 Use of Arduino 15

3.5 Different type of arduino Board 16

3.6 Arduino Uno R3 17

3.7 Lilypad Arduino Board 17

3.8 Red Board Arduino Board 18

3.9 Arduino Mega (R3) Board 18

3.10 Arduino Leonardo Board: 19

3.11 The Arduino Shields 19

3.12 Advantages of Arduino Uno 24

3.13 Effortless Functions 24

3.14 Large community 24

3.16 Controller 25

3.17 Led 26

3.18 Bluetooth Module 26

3.19 Arduino Bluetooth Communication Example Source Code 28

3.20 Description 29

3.21 Use of 4 grounds in the IC 31

3.22 Use of Capacitors 31

Chapter Four System Model and Result

4.1 System Model and Assumption 32

4.2 Wi-Fi Module 32

4.3 Air Quality Monitoring Sensor 33

4.4 16*2 LCD Display 34

4.5 Sound Sensor 35

4.6 Result 36

4.7 Cost of the Project 37

Chapter Five Discussion and Conclusion

5.1 Discussion 37

5.2 Conclusions 37

5.3 Future Work 38

References 39

Appendix 41

List of Figures

FIGURE NO.	FIGURE NAME	PAGE NO.
2.1	Block diagram of Air and Sound Pollution Monitoring System.	6
2.2	Circuit diagram of Air and Sound Pollution Monitoring System.	6
3.1	Arduino Board	13
3.2	Connection of Arduino	14
3.3	Arduino Uno (R3)	17
3.4	LilyPad Arduino Board	18
3.5	RedBoard Arduino Board	18
3.6	Arduino Mega (R3) Board	19
3.7	Arduino Leonardo Board	19
3.8	Arduino Shields	20
3.9	Arduino UNO	21
3.10	HC-05 Bluetooth module	27
3.11	Circuit Schematics	28
3.12	Pin No. - Pin Characteristics	30
4.1	Wi-Fi module.	33
4.2	Air quality monitoring sensor	34
4.3	LCD Display	35
4.4	Sound Sensor	36

List of Table

Table 1: Components and cost of the project. **37**

LIST OF ABBREVIATIONS

IOT= Internet of Thing.

DC= Direct Current

LCD= Liquid Crystal Display

WSN= Wireless Sensor Networks

Chapter One

Introduction

1.1 Introduction

The main objective of IOT Air & Sound Monitoring System is that the Air and sound pollution is a growing issue these days. It is necessary to monitor air quality and keep it under control for a better future and healthy living for all. Here we propose an air quality as well as sound pollution monitoring system that allows us to monitor and check live air quality as well as sound pollution in an area through IOT. System uses air sensors to sense presence of harmful gases/compounds in the air and constantly transmit this data. Also, system keeps measuring sound level and reports it. The sensors interact with raspberry pi which processes this data and transmits it over the application. This allows authorities to monitor air pollution in different areas and act against it. Also, authorities can keep a watch on the noise pollution near schools, hospitals and no honking areas, and if system detects air quality and noise issues it alerts authorities so they can take measures to control the issue. Some future consumer applications envisioned for IoT sound like science fiction, but some of the more practical and realistic sounding possibilities for the technology include: Receiving warnings on your phone or wearable device when IoT networks detect some physical danger is detected nearby. Self-parking automobiles. Automatic ordering of groceries and other home. Automatic tracking of exercise habits and other day-to-day personal activity including goal tracking and regular progress reports. Network Devices and the Internet of Things All kinds of ordinary household gadgets can be modified to work in an IoT system. Wi-Fi network adapters, motion sensors, cameras, microphones and other instrumentation can be embedded in these devices to enable them for work in the Internet of Things. Home automation systems already implement primitive versions of this concept for things like light bulbs, plus other devices like wireless scales and wireless blood pressure monitors that each represent early examples of IoT gadgets.

Some of the research works carried out for pollution monitoring system in wide area for making the smart environment, different techniques and algorithms used are discussed in this paper. Architectures, applications, and related design issues are discussed. In this work, they highlight how smart environments represent the trend towards increasing automated environmental monitoring with association of the wireless sensing devices to environmental events and phenomena. The environmental behaviours are collected actively as a streaming

database to identify the environmental conditions and efficient decision making, dissemination by sensors is provided. A secure access standard and an intelligent remote protocol is delivered which is essential for operating, managing, reprogramming, and configuring the wireless sensor devices, for monitoring the remote or hostile environments using environmental monitoring systems installed for independent operation. A unified access with respect to the context model and adaptive applications are developed, along with this the executable models is discussed with its state at runtime. A seamless interaction model is developed for user interface adaption and reconfiguration to build context-adaptive applications over a test bed. A layered architecture of sensors and context models is proposed to support context modelling in different phases of development. Towards a Green Campus with the Internet of Things – the Application of Lab Management adopts the concept of "Internet of Things" and provides the idea of energy-saving by properly managing the computers and air conditioners. The architecture of a green campus and the prototype of the system are demonstrated here the computers and air conditioners are objects of interest. ZigBee device and RFID with temperature module are used to develop along with the wireless sensor network. The objective is to design and develop efficient, economical, flexible, realistic and real-time wellness sensor networks. The sensor and actuator nodes are deployed depending on the wireless networking technologies and generate real-time data that is related to the movements of the object and its usage inside the home. The ZigBee based Digi XBee Series 2 is picked up as RF module for monitoring the system. Further the extension from smart home system to smart buildings along with reliability and system performance are demonstrated. Learning Activity Models for Multiple Agents in a Smart Space for modelling and automating resident activity in multiple-resident intelligent environments, using passive sensors to identify the individuals and their activities in an intelligent environment is presented.

1.2 Executive Summary

The pollution of air and sound is increasing abruptly. To bring it under control its monitoring is majorly recommended. To overcome this issue, we are introducing a system through which the level of sound and the existence of the harmful gases in the surroundings can be detected. The growing pollution at such an alarming rate has started creating trouble for the living beings, may it be high decibels or toxic gases present in the environment leaves a harmful effect on human's health and thus needs a special attention.

The main objective of IOT Air & Sound Monitoring System is that the Air and sound pollution is a growing issue these days. It is necessary to monitor air quality and keep it under control for a better future and healthy living for all.

Here we propose an air quality as well as sound pollution monitoring system that allows us to monitor air quality as well as sound pollution in an area through IOT. System uses air sensors to sense presence of harmful gases in the air and constantly transmit this data. This system allows authorities to monitor air pollution in areas and act against it. Also, authorities can keep a watch on the noise pollution near schools, hospitals and no honking areas, and if system detects air quality and noise issues it alerts authorities so they can take measures to control the issue.

The Air and Sound Pollution Monitoring System consists of the Arduino Uno which is based on ATmega328 microcontroller. Arduino is also known as the mind of the device as everything in this system is controlled by the Arduino. Initially, the Arduino is provided with a 5 V DC supply through port 9600.Network Devices and the Internet of Things All kinds of ordinary household gadgets can be modified to work in an IoT system. Wi-Fi network adapters can be embedded in these devices to enable them for work in the Internet of Things.

Noise dust monitoring station is a special monitoring equipment for projects under construction. The equipment has 1 channel louver box (temperature, humidity, noise, PM2.5, PM10, air pressure, lighting, TSP) collection、1 channel Wind speed acquisition、1 channel wind-direction 、2 channel switching acquisition、2 channel 4-20mA analog acquisition 2 channel relay output、1 way RS485 output from station. The device can upload data to the monitoring software platform through GPRS. At the same time, the host can connect the 1 way LED screen (54cm*102cm) to display the current numerical information in real time.

1.3 Background

The goal of building a smart city is to improve quality of life by using technology to improve the efficiency of services and meet residents' needs. Information and Communication Technology allows city officials to interact directly with the public to tell what is happening in the city, how the city is evolving, and how to enable a better quality of life. A Smart City is one with at least one initiative addressing one or more of the following six characteristics: Smart Governance, Smart People, Smart Living, Smart Mobility, Smart Economy and Smart Environment. In this system, an application was developed that is going to bear a hand in this

campaign. An area that is being surveyed for estimating how much the area is affected by pollution. The constituents of air along with its proportion are calculated and if it is higher than normal then the officials are intimated about it. Then the people are evacuated to a safe place. The description about the integrated network architecture and the interconnecting mechanisms for the reliable measurement of parameters by smart sensors and transmission of data via internet is being presented. The longitudinal learning system could provide a self-control mechanism for better operation of the devices in monitoring stage. The framework of the monitoring system was based on a combination of pervasive distributed sensing units, information system for data aggregation, and reasoning and context awareness. Results are encouraging as the reliability of sensing information transmission through the proposed integrated network architecture is 97%. The prototype was tested to generate real-time graphical information rather than a test bed scenario. In this research, a real time monitoring of three gases are simulated in real environment. Gases that are monitored in this implementation are Carbon monoxide, carbon dioxide & Sulphur dioxide. In this simulation, these three gases are successfully tested in four areas. Then extended the simulated results to update in web. As the technology increase, the degree of automation (minimizing the man power) in the almost all sectors are also increases. Wireless Sensor Networks (WSN) are gaining the ground in all sectors of life; from homes to factories, from traffic control to environmental monitoring. The air pollution monitoring system contains sensors to monitor the interested pollution parameter in environment. They simulated the three air pollutants gases including carbon monoxide, carbon dioxide & sulphur dioxide in air because these gases decide the degree of pollution level. They also applied the approach in various applications like leaking cooking gas in our homes, to alert the workers in oil & gas industry to detect the leakage etc. This simulation creates the awareness in people in cities. Due to recent technological advances, the construction material for small and low cost sensors became technically and economically feasible. Even though, Industrialization increase the degree of automation and at the same time it increases the air pollution by releasing the unwanted gases in environment especially in industrial areas like Visakhapatnam. To implement the project, they selected four areas to deploy the application in Visakhapatnam. To detect percentage of pollution, we used the array of sensor to measure gas quantity in the physical environment in surrounding the sensor and convert them into an electrical signal for processing. Such a signal reveals some properties about interested gas molecule. A huge number of these sensors nodes can be networked in many applications that require unattended operations creates a wireless sensor network. Wireless sensors are devices that range in size

from a piece of glitter to a deck of cards. Integration of various components create the air pollution monitoring system. They are functionally composed of: A Sensing unit that is designed and programmed to sense gas pollutants in air in four busy areas in Visakhapatnam. Some common examples of properties or parameters that are monitored are light, temperature, humidity, pressure, etc. a converter that transforms the sensed signal from an analog to a digital signal; A Processing Unit in the Microcontroller, process the signals sensed form sensor with help of embedded memory, operating system and associated circuitry. A Radio component that can communicate the sink node or ZigBee router which collects the sensed pollution gas level from sensor node and forwards to pollution server which is in our campus. Powering these components is typically one or two small batteries.. The sensors self-organize themselves in a radio network using a routing algorithm, monitor the area for measure the gas levels in air, and transmit the data to a central node, sometimes called a pollution server or base station (interfaced with coordinator), or sink node(interfaced with router), that collects the data from all of the sensors.

1.4 Objectives

- The main objective of this project is to design and implement an efficient monitoring system through which the required parameters are monitored remotely using internet and the data gathered from the sensors are stored in the cloud and to project the estimated trend on the web browser.
- To monitor air quality and keep it under control for a better future and healthy living for all.

1.5 Methodology

The Air and Sound Pollution Monitoring System consists of the Arduino Uno which is based on ATmega328 microcontroller. Arduino is also known as the mind of the device as everything in this system is controlled by the Arduino. Initially, the Arduino is provided with a 5 V DC supply through port 9600.Network Devices and the Internet of Things All kinds of ordinary household gadgets can be modified to work in an IoT system. Wi-Fi network adapters can be embedded in these devices to enable them for work in the Internet of Things.

Chapter Two

Block and Circuit Diagram

2.1 Block Diagram

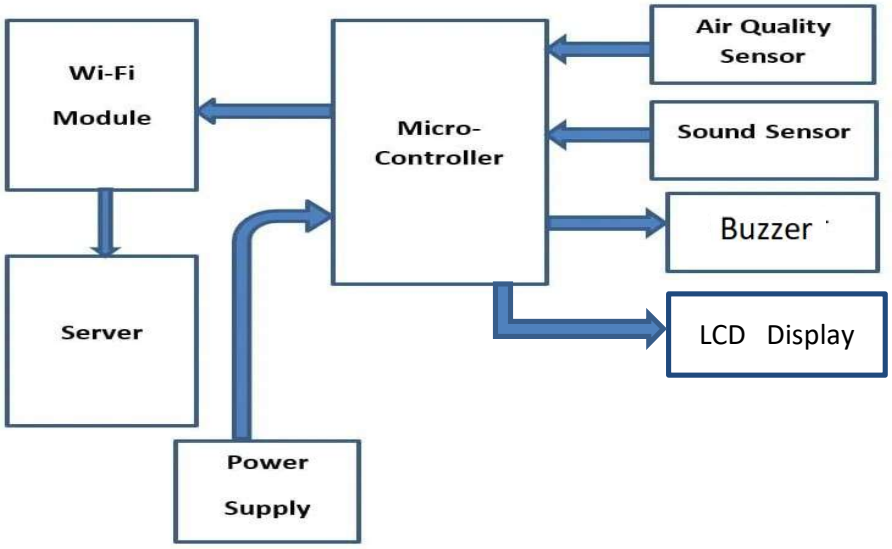


Fig 2.1: Block diagram of Air and Sound Pollution Monitoring System

2.2 Circuit Diagram

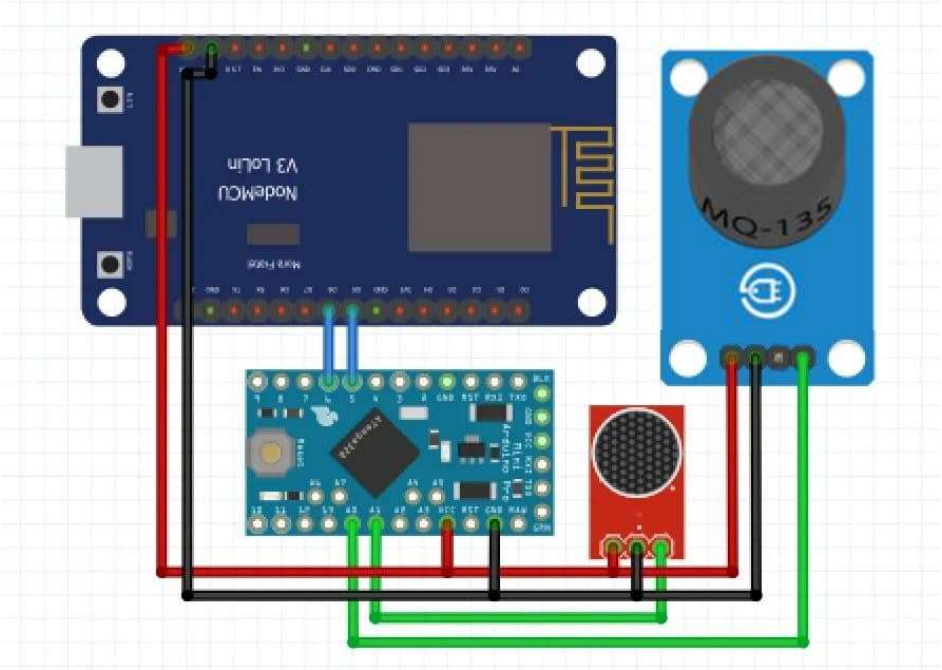


Fig 2.2: Circuit diagram of Air and Sound Pollution Monitoring System.

2.3 Working Procedure

Here we propose an air quality as well as sound pollution monitoring system that allows us to monitor and check live air quality as well as sound pollution in an area through IOT. System uses air sensors to sense presence of harmful gases/compounds in the air and constantly transmit this data. Also, system keeps measuring sound level and reports it. The sensors interact with arduino which processes this data and transmits it over the application. This allows authorities to monitor air pollution in different areas and act against it. Also, authorities can keep a watch on the noise pollution near schools, hospitals and no honking areas. Network Devices and the Internet of Things All kinds of ordinary household gadgets can be modified to work in an IoT system. Wi-Fi network adapters, air sensors, buzzer and other instrumentation can be embedded in these devices to enable them for work in the Internet of Things. The level of pollution is increasing rapidly due to factors like industries, urbanization, increasing in population, vehicle use which can affect human health. IOT Based Air Pollution Monitoring System is used to monitor the Air Quality over a web server using Internet. It will trigger an alarm when the air quality goes down beyond a certainlevel, means when there are sufficient amount of harmful gases present in the air like CO2, smoke, alcohol, benzene, NH3 and NOx. It will show the air quality in PPM on the LCD and as well as on webpage so that air pollution can be monitored very easily.

Air pollution is the biggest problem of every nation, whether it is developed or developing. Health problems have been growing at faster rate especially in urban areas of developing countries where industrialization and growing number of vehicles leads to release of lot of gaseous pollutants. Harmful effects of pollution include mild allergic reactions such as irritation of the throat, eyes and nose as well as some serious problems like bronchitis, heart diseases, pneumonia, lung and aggravated asthma. According to a survey, due to air pollution 50,000 to 100,000 premature deaths per year occur in the U.S. alone. Whereas in EU number reaches to 300,000 and over 3,000,000 worldwide. IOT Based Air Pollution Monitoring System monitors the Air quality over a web server using Internet and will trigger an alarm when the air quality goes down beyond a certain threshold level, means when there are sufficient amount of harmful gases present in the air like CO2, smoke, alcohol, benzene, NH3, LPG and NOx. It will show the air quality in PPM on the LCD and as well as on webpage so that it can monitor it very easily. LPG sensor is added in this system which is used mostly in houses. The system will show temperature and humidity. The system can be

installed anywhere but mostly in industries and houses where gases are mostly to be found and gives an alert message when the system crosses threshold limit.

2.4 Problem Statement

An effective natural observing framework is essential to screen and estimate the conditions in the event of surpassing endorsed level of parameter (for example, commotion, CO and radiation levels). At the point when the items like condition furnished with sensor gadgets, smaller scale controller and different programming application turn into a self-securing and self-observing condition. The drawbacks of the conventional monitoring instruments are their large size, heavy weight and extraordinary expensiveness. These lead to sparse deployment of the monitoring stations. In order to be effective, the locations of the monitoring stations need careful placement because the air pollution situation in urban areas is highly related to human activities (e.g. construction activities) and location-dependent (e.g., the traffic choke-points have much worse air quality than average). IOT Based Air Pollution Monitoring System monitors the Air Quality over a webserver using internet and will trigger an alarm when the air quality goes down beyond a certain level, means when there are amount of harmful gases present in the air like CO2, smoke, alcohol, benzene, NH3, NOx and LPG. The system will show the air quality in PPM on the LCD and as well as on webpage so that it can be monitored very easily. Temperature and Humidity is detected and monitored in the system. LPG gas is detected using MQ6 sensor and MQ135 sensor is used for monitoring Air Quality as it detects most harmful gases and can measure their amount accurately. In this IOT project, it can monitor the pollution level from anywhere using your computer or mobile. This system can be installed anywhere and can also trigger some device when pollution goes beyond some level, like we can send alert SMS to the user.

2.5 Required Components

- Arduino UNO
- Air Quality Monitoring Sensor
- LM393 (Soundsensor)
- ESP8266 WIFI Module
- Server
- Power Supply
- Indicator

2.6 Internet of Things

The Internet of things (IoT) describes physical objects (or groups of such objects) that are embedded with sensors, processing ability, software, and other technologies that connect and exchange data with other devices and systems over the Internet or other communications networks. The field has evolved due to the convergence of multiple technologies, including ubiquitous computing, commodity sensors, increasingly powerful embedded systems, and machine learning. Traditional fields of embedded systems, wireless sensor networks, control systems, automation (including home and building automation), independently and collectively enable the Internet of things. In the consumer market, IoT technology is most synonymous with products pertaining to the concept of the "smart home", including devices and appliances (such as lighting fixtures, thermostats, home security systems and cameras, and other home appliances) that support one or more common ecosystems, and can be controlled via devices associated with that ecosystem, such as smartphones and smart speakers. The IoT can also be used in healthcare systems. There are a number of concerns about the risks in the growth of IoT technologies and products, especially in the areas of privacy and security, and consequently, industry and governmental moves to address these concerns have begun, including the development of international and local standards, guidelines, and regulatory frameworks

2.7 Internet of Things Applications

i) Consumer applications

A growing portion of IoT devices are created for consumer use, including connected vehicles, home automation, wearable technology, connected health, and appliances with remote monitoring capabilities.

ii) Smart home

IoT devices are a part of the larger concept of home automation, which can include lighting, heating and air conditioning, media and security systems and camera systems. Long-term benefits could include energy savings by automatically ensuring lights and electronics are turned off or by making the residents in the home aware of usage. A smart toilet seat that measures blood pressure, weight, pulse and oxygen levels. A smart home or automated home could be based on a platform or hubs that control smart devices and appliances. For instance, using Apple's HomeKit, manufacturers can have their home products and accessories

controlled by an application in iOS devices such as the iPhone and the Apple Watch. This could be a dedicated app or iOS native applications such as Siri. This can be demonstrated in the case of Lenovo's Smart Home Essentials, which is a line of smart home devices that are controlled through Apple's Home app or Siri without the need for a Wi-Fi bridge. There are also dedicated smart home hubs that are offered as standalone platforms to connect different smart home products and these include the Amazon Echo, Google Home, Apple's HomePod, and Samsung's Smart Things Hub. In addition to the commercial systems, there are many non-proprietary, open source ecosystems; including Home Assistant, OpenHAB and Domoticz.

iii) Elder care

One key application of a smart home is to provide assistance for those with disabilities and elderly individuals. These home systems use assistive technology to accommodate an owner's specific disabilities. Voice control can assist users with sight and mobility limitations while alert systems can be connected directly to cochlear implants worn by hearing-impaired users. They can also be equipped with additional safety features. These features can include sensors that monitor for medical emergencies such as falls or seizures.[38] Smart home technology applied in this way can provide users with more freedom and a higher quality of life.

Chapter Three

Components Of This Project

3.1 Definition of Arduino

Arduino is a user based community that is indulged in the design, development and sales of open-source software, open source hardware, and microcontroller-based kits that are used in the manufacturing of interactive objects and digital devices that have an ability of sensing and controlling physical devices. The project is formed on the basis of microcontroller board designs that have been developed by a number of vendors through the deployment of different microcontrollers. An integrated development environment is provided by Arduino project for the development of these microcontrollers. This environment is based on Arduino project's programming language that supports both C as well as C++. Arduino is an open source computer hardware and software company, project, and user community that designs and manufactures single-board microcontrollers and microcontroller kits for building digital devices and interactive objects that can sense and control objects in the physical and digital world. The project's products are distributed as open-source hardware and software, which are licensed under the GNU Lesser General Public License (LGPL) or the GNU General Public License (GPL),[1]permitting the manufacture of Arduino boards and software distribution by anyone. Arduino boards are available commercially in preassembled form, or as do-it-yourself (DIY) kits. Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards or Breadboards (*shields*) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs from personal computers. The microcontrollers are typically programmed using a dialect of features from the programming languages C and C++. In addition to using traditional compiler toolchains, the Arduino project provides an integrated development environment (IDE) based on the Processing language project. The Arduino project started in 2003 as a program for students at the Interaction Design Institute Ivrea in Ivrea, Italy,[2] aiming to provide a low-cost and easy way for novices and professionals to create devices that interact with their environment using sensors and actuators. Common examples of such devices intended for beginner hobbyists include simple robots, thermostats, and motion detectors.The

name Arduino comes from a bar in Ivrea, Italy, where some of the founders of the project used to meet. The bar was named after Arduin of Ivrea, who was the margraveof the March of Ivrea and King of Italy from 1002 to 1014.https://en.wikipedia.org/wiki/Arduino]

3.2 History of Arduino

In 2005, in Ivrea, Italy, a project was initiated to make a device for controlling student-built interactive design projects that was less expensive than other prototyping systems available at the time. One of the cofounders, Massimo Banzi, named this piece of hardware Arduino in honor of Bar di Re Arduino (In 1002, King Arduin became the ruler of the Italy. Today, the Bar di Re Arduino, a pub on a cobblestoned street in town, honors his memory), and began producing boards in a small factory located in the same region as the computer company Olivetti. The Arduino project is a fork of the open source Wiring platform and is programmed using a Wiring-based language (syntax and libraries), similar to C++ with some slight simplifications and modifications, and a Processing-based integrated development environment (IDE). Arduino was built around the Wiring project of Hernando Barragan. Wiring was Hernando's thesis project at the Interaction Design Institute Ivrea. It was intended to be an electronic version of Processing that used our programming environment and was patterned after the Processing syntax. Arduino would not exist without Wiring and Wiring would not exist without Processing. Currently, there are more than 200 distributors of Arduino products around the world. About 80 percent of people who buy this product are from the United States and Europe. The interest in this product is rising in the China, India, and South America markets. Over the years, new designs of the Arduino have been created. The original design is called the Arduino Uno. Some of the Arduino designs are the Arduino Mega, Arduino Nano, LilyPad Arduino, and Arduino Ethernet. This past year, the Arduino gained publicity by partnering with Google. Google released the Android ADK, or Accessory Development Kit, which is based on the Anduino. A person can build an Android app that uses the Phone’s camera, motion sensors, touch screen, and internet connectivity. It looks as though the Arduino is creating a new, cheaper way of programming. It does not seem to be going away any time soon; it is only getting more popular. Hernando Barragán, who was a Colombian student, formulated Wiring – a development platform as a part of this Master’s thesis project in the year 2004.



Fig 3.1: Arduino Board

This project was submitted in Ivrea, Italy at the Interaction Design Institute Ivrea (IDII). The supervisors for Barragán's project were Casey Reas, who is well known for the work he did on Processing Programming Language, and Massimo Banzi.The basic aim that underlay the development of this project was the creation of simplified and low cost tools that facilitated non-engineers in the creation of digital projects. The three major components of the Wiring platform were: a hardware PCB in combination with ATmega128 microcontroller, an integrated development environment (IDE) which was developed on the basis of Processing and library functions that aided in the easy programming of the microcontroller.Massimo Banzi, and David Cuartielles along with David Mellis (who was a student in IDII at that time), further developed the Wiring Platform. This was done through the addition of support for a cheaper version of ATmega8 microcontroller to the platform in the year 2005. However, these individuals that stopped working on Wiring Platform and used its source code to develop an entirely new platform called Arduino.The initial team that was indulged in the development of Arduino consisted of David Cuartielles, Massimo Banzi, Gianluca Martino, David Mellis, and Tom Igoe.The project got its name from a bar, which is situated in Ivrea, as it is the location where some of the founding team members of the project conducted their meetings. The completion of the Wiring Platform was accompanied by the development and creation of low cost and lighter versions of the same platform. These versions were made

available on the open source community. The idea of creation and open source access was promoted by David Cuartielles and other associated researchers.

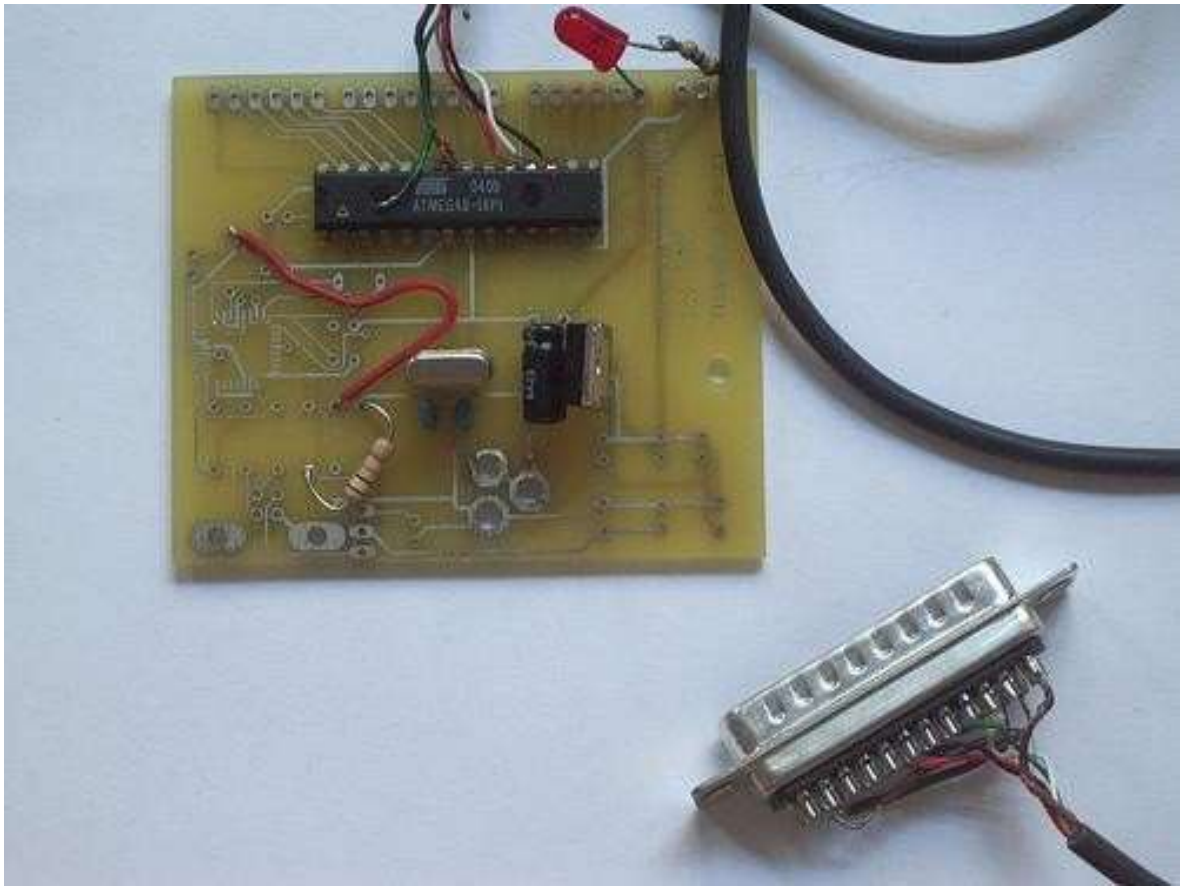


Fig 3.2:Connection of Arduino

The first prototype board, made in 2005, was a simple design, and it wasn't called Arduino. Massimo Banzi would coin the name later that year.

3.3 Introduction of Arduino

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing. Over the years Arduino has been the brain of thousands of projects, from everyday objects to complex scientific instruments. A worldwide community of makers - students, hobbyists, artists, programmers, and professionals has gathered around this open-source platform, their

contributions have added up to an incredible amount of accessible knowledge that can be of great help to novices and experts alike. Arduino was born at the Ivrea Interaction Design Institute as an easy tool for fast prototyping, aimed at students without a background in electronics and programming. As soon as it reached a wider community, the Arduino board started changing to adapt to new needs and challenges, differentiating its offer from simple 8-bit boards to products for IoT applications, wearable, 3D printing, and embedded environments. All Arduino boards are completely open-source, empowering users to build them independently and eventually adapt them to their particular needs. The software, too, is open-source, and it is growing through the contributions of users worldwide.

3.4 Use of Arduino

Thanks to its simple and accessible user experience, Arduino has been used in thousands of different projects and applications. The Arduino software is easy-to-use for beginners, yet flexible enough for advanced users. It runs on Mac, Windows, and Linux. Teachers and students use it to build low cost scientific instruments, to prove chemistry and physics principles, or to get started with programming and robotics. Designers and architects build interactive prototypes, musicians and artists use it for installations and to experiment with new musical instruments. Makers, of course, use it to build many of the projects exhibited at the Maker Faire, for example. Arduino is a key tool to learn new things. Anyone - children, hobbyists, artists, programmers - can start tinkering just following the step by step instructions of a kit, or sharing ideas online with other members of the Arduino community. There are many other microcontrollers and microcontroller platforms available for physical computing. Parallax Basic Stamp, Netmedia's BX-24, Phidgets, MIT's Handyboard, and many others offer similar functionality. All of these tools take the messy details of microcontroller programming and wrap it up in an easy-to-use package. Arduino also simplifies the process of working with microcontrollers, but it offers some advantage for teachers, students, and interested amateurs over other systems:

- Inexpensive - Arduino boards are relatively inexpensive compared to other microcontroller platforms. The least expensive version of the Arduino module can be assembled by hand, and even the pre-assembled Arduino modules cost less than $50
- Cross-platform - The Arduino Software (IDE) runs on Windows, Macintosh OSX, and Linux operating systems. Most microcontroller systems are limited to Windows.

- Simple, clear programming environment - The Arduino Software (IDE) is easy-to-use for beginners, yet flexible enough for advanced users to take advantage of as well. For teachers, it's conveniently based on the Processing programming environment, so students learning to program in that environment will be familiar with how the Arduino IDE works.
- Open source and extensible software - The Arduino software is published as open source tools, available for extension by experienced programmers. The language can be expanded through C++ libraries, and people wanting to understand the technical details can make the leap from Arduino to the AVR C programming language on which it's based. Similarly, you can add AVR-C code directly into your Arduino programs if you want to.
- Open source and extensible hardware - The plans of the Arduino boards are published under a Creative Commons license, so experienced circuit designers can make their own version of the module, extending it and improving it. Even relatively inexperienced users can build the breadboard version of the module in order to understand how it works and save money.
- The Arduino is a small computer that you can program to read information from the world around you and to send commands to the outside world. All of this is possible because you can connect several devices and components to the Arduino to do what you want. You can do amazing projects with it, there is no limit for what you can do, and using your imagination everything is possible. The Arduino is the board that you can see on the picture below. Basically, it is a tiny computer that you can connect to electrical circuits. This makes it easy to read inputs – read data from the outside – and control outputs - send a command to the outside. The brain of this board (Arduino Uno) is an ATmega328p chip where you can store your programs that will tell your Arduino what to do.

3.5 Different Types of Arduino Boards

The list of Arduino boards includes the following such as

- Arduino Uno (R3)
- LilyPad Arduino
- Red Board

- Arduino Mega (R3)
- Arduino Leonardo

3.6 Arduino Uno (R3)

The Uno is a huge option for your initial Arduino. It consists of 14-digital I/O pins, where 6-pins can be used as PWM (pulse width modulation outputs), 6-analog inputs, a reset button, a power jack, a USB connection and more. It includes everything required to hold up the microcontroller; simply attach it to a PC with the help of a USB cable and give the supply to get started with a AC-to-DC adapter or battery.



Fig 3.3: Arduino Uno (R3)

3.7 Lilypad Arduino Board

The Lily Pad Arduino board is a wearable e-textile technology expanded by Leah " Buechley"and considerately designed by "Leah and SparkFun". Each board was imaginatively designed with huge connecting pads & a smooth back to let them to be sewn into clothing using conductive thread. This Arduino also comprises of I/O, power, and also sensor boards which are built especially for e-textiles. These are even washable!

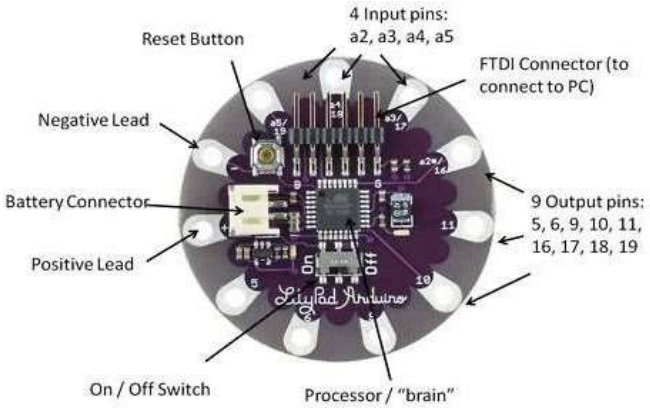


Fig 3.4: LilyPad Arduino Board

3.8 Red Board Arduino Board

The Red Board a Aduino board can be programmed using a Mini-B USB cable using the Arduino IDE. It will work on Windows 8 without having to modify your security settings.It is more constant due to the USB or FTDI chip we used and also it is entirely flat on the back. Creating it is very simple to utilize in the project design. Just plug the board, select the menu option to choose an Arduino UNO and you are ready to upload the program. You can control the RedBoard over USB cable using the barrel jack.

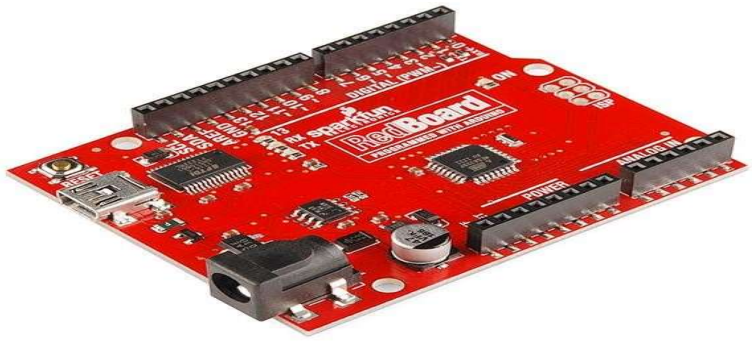


Fig 3.5:RedBoard Arduino Board

3.9 Arduino Mega (R3) Board

The Arduino Mega is similar to the UNO's big brother. It includes lots of digital I/O pins (from that, 14-pins can be used as PWM o/ps), 6-analog inputs, a reset button, a power jack, a USB connection and a reset button. It includes everything required to hold up the microcontroller; simply attach it to a PC with the help of a USB cable and give the supply to get started with a AC-to-DC adapter or battery.The huge number of pins make this Arduino

board very helpful for designing the projects that need a bunch of digital i/ps or o/ps like lots buttons.

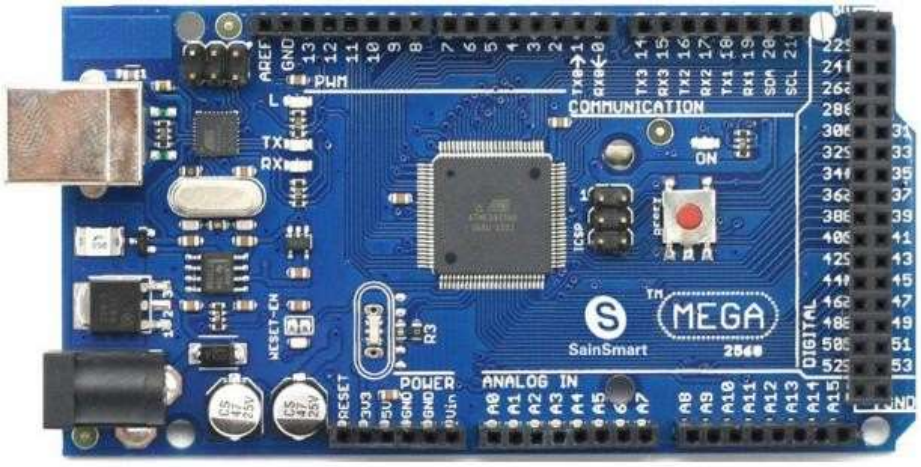


Fig 3.6:Arduino Mega (R3) Board

3.10 Arduino Leonardo Board

The first development board of an Arduino is the Leonardo board. This board uses one microcontroller along with the USB. That means, it can be very simple and cheap also. Because this board handles USB directly, program libraries are obtainable which let the Arduino board to follow a keyboard of the computer, mouse, etc.

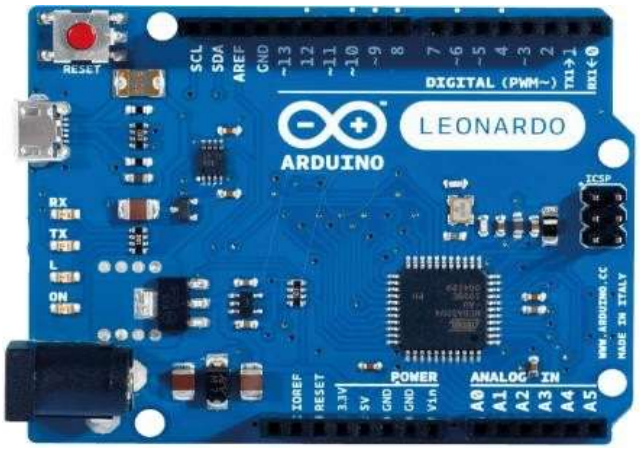


Fig 3.7:Arduino Leonardo Board

3.11 The Arduino Shields

Additionally, Arduino shields are pre built circuit boards used to connect to a number of Arduino boards. These shields fit on the top of the Arduino compatible boards to provide an

additional capabilities like connecting to the internet, motor controlling, providing wireless communication, LCD screen controlling, etc..The different types of an Arduino shields are

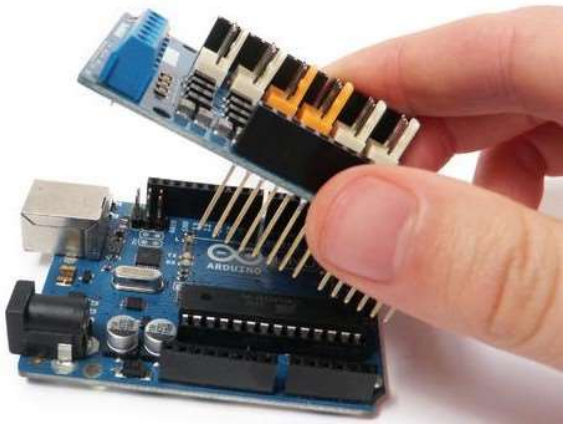


Fig 3.8:Arduino Shields

- Wireless Shields
- The GSM Shield
- The Ethernet Shield
- The Proto Shields

Thus, this is all about different types of Arduino boards.We hope that you have got a better understanding of this concept. Furthermore, any queries regarding this concept or to implement an Arduino board based Projects, please give your valuable suggestions by commenting in the comment section below. Here is a question for you, what is the function of Arduino boards.

Photo Credits:

- Arduino Uno (R3) tekntools
- LilyPad Arduino Board wordpress
- RedBoard Arduino Board sparkfun
- Arduino Mega (R3) Board sainsmart
- Arduino Leonardo Board reichelt
- Arduino Shields intorobotics
- Arduino Boards robokitsindia

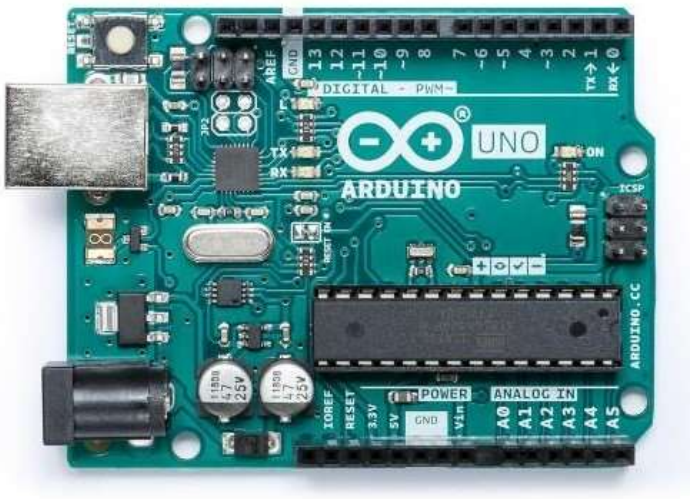


Fig 3.9: Arduino UNO

Arduino Uno R3 Specification:

Microcontroller: ATmega328

Operating Voltage: 5V

Input Voltage (recommended): 7-12V

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: 32 KB of which 0.5 KB used by bootloader

SRAM: 2 KB (ATmega328)

EEPROM: 1 KB (ATmega328)

Clock Speed: 16 MHz

There are several types of Arduino Boards: Arduino Uno, Zero, Duemilanove, Diecimila, Leonardo, Nano, Mega, amongst others. Figure 2. Arduino Uno, Nano and Mega You can check all of them on this web link below: https://www.arduino.cc/en/Main/Products?from=Main.Hardware. In this eBook, we will focus on Arduino Uno, which is the most often used board in hobbyists' projects.

The UNO is the best board to get started with electronics and coding. If this is your first experience tinkering with the platform, the UNO is the most robust board you can start playing with. The UNO is the most used and documented board of the whole Arduino family.

Arduino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, 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.. You can tinker with your UNO without worring too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again."Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.

- Microcontroller: the ATmega328p is the Arduino brain. Everything on the Arduino board is meant to support this microcontroller
- Digital pins: Arduino has 14 digital pins, labeled from 0 to 13 that can act as inputs or outputs. o When set as inputs, these pins can read voltage. They can only read two different states HIGH or LOW. o When set as outputs, these pins can apply voltage. They can only apply 5V (HIGH) or 0V (LOW). LATEST PROJECTS - ASK QUESTIONS - DOWNLOAD OTHER RNT PRODUCTS 6
- PWM pins: These are digital pins marked with a ~ (pins 11, 10, 9, 6, 5 and 3). PWM stands for “pulse width modulation” and allows making digital pins output “fake” varying amounts of voltage. You’ll learn more about PWM later.
- TX and RX pins: digital pins 0 and 1. The T stands for “transmit” and the R for “receive”. Arduino uses these pins to communicate with the computer. Avoid using these pins, unless you’re running out of pins
- LED attached to digital pin 13: This is useful for an easy debugging of the Arduino sketches.
- TX and RX pins: these pins blink when there are information being sent between the computer and the Arduino.

- Analog pins: the analog pins are labeled from A0 to A5 and are most often used to read analog sensors. They can read different amounts of voltage between 0 and 5V. Additionally, they can also be used as digital output/input pins like the digital pins
- Power pins: The Arduino has 3.3V or 5V supply, which is really useful since most components require 3.3V or 5V. The pins labelled as “GND” are the ground pins.
- Reset button: when you press that button, the program that is currently being run in your Arduino will start from the beginning. You also have a Reset pin next to the power pins that acts as reset button. Power ON LED: will be on since power is applied to the Arduino
- USB jack: Connecting a male USB A to male USB B cable is how you upload programs from your computer to your Arduino board. This also powers your Arduino. Figure 5. Male USB A to male USB B cable
- Power jack: The power jack is where you connect a component to power up your Arduino (recommended voltage is 5V). There are several ways to power up your Arduino: rechargeable batteries, disposable batteries, wall-warts and solar panel, for example. For more information about this subject you can read this blog post on Random

Brackets you write the pin you want to control and a number between 0 and 255. Reading an input To read an analog input you use the function analog Read () and for a digital input you use digital Read ().The best way for you to learn about Arduino is by putting your hands to work. So, let’s start building some projects

With the function setup() you type the code that you want your Arduino to run only once. For example, you tell your Arduino if a certain pin will be an output or an input. In this case, we are setting pin13 as an output. If you want to change the pin, you just need to replace “13” with the number of the pin you want to control. In the loop() function, we can write what we want our Arduino to do. The loop() , as the name says it’s a loop, and so, it will run forever, over and over again. You have already read previously about the function digitalWrite(), you can see that in brackets we have (13, HIGH), which means that we want the pin 13 to be HIGH. As we have an LED in pin 13, the LED will turn on. Then, the function delay () waits for a number of milliseconds. In this case it’s 1000 milliseconds, which is 1 second. After this 1 second, we can see that the digitalWrite() function has “LOW” written, which means that the LED will turn off. Then, we’ll wait for another second, and the loop will start again. To upload the sketch to your Arduino, make sure that your board is connected to your computer

and that the right serial port is selected. Then you need to press the upload button that is highlighted below: Now, you will see the magic happening. The LED turns on for 1 second and then off for 1 second, and then on for 1 second, and so on. To better understand how the code works, try to change it on your own. For example, change the number inside the delay() function, upload the new sketch to your Arduino and see what happens.

3.12 Advantages of Arduino Uno

The biggest advantage of Arduino is its ready to use structure. As Arduino comes in a complete package form which includes the 5V regulator, a burner, an oscillator, a micro-controller, serial communication interface, LED and headers for the connections. You don't have to think about programmer connections for programming or any other interface. Just plug it into USB port of your computer and that's it. Your revolutionary idea is going to change the world after just few words of coding.

Examples of codes:

Another big advantage of Arduino is its library of examples present inside the software of Arduino. I'll explain this advantage using an example of voltage measurement. For example if you want to measure voltage using ATmega8 micro-controller and want to display the output on computer screen then you have to go through the whole process. The process will start from learning the ADC's of micro-controller for measurement, went through the learning of serial communication for display and will end at USB - Serial converters.

On the other hand, if you want to measure the voltage using Arduino. Just plug in your Arduino and open the Read Analog Voltage.

3.13 Effortless Functions

During coding of Arduino, you will notice some functions which make the life so easy. Another advantage of Arduino is its automatic unit conversion capability. You can say that during debugging you don't have to worry about the units conversions. Just use your all force on the main parts of your projects. You don't have to worry about side problems.

3.14 Large Community

There are many forums present on the internet in which people are talking about the Arduino. Engineers, hobbyists and professionals are making their projects through Arduino. You can

easily find help about everything. Moreover the Arduino website itself explains each and every functions of Arduino.

So, we should conclude the advantage of Arduino by saying that during working on different projects you just have to worry about your innovative idea. The remaining will handle by Arduino itself.

3.15 Controller

A smart phone Android operated robot. Now here is a simple to control your robot/robo car using Bluetooth module HC-06 and 89c2051 microcontroller with your android Smartphone device. The controlling devices of the whole system are a microcontroller. Bluetooth module, DC motors are interfaced to the microcontroller. The data receive by the Bluetooth module from android smart phone is fed as input to the controller. The controller acts accordingly on the DC motor of the robot. The robot in the project can be made to move in all the four directions using the android phone. The direction of the robot is indicators using LED indicators of the Robot system. In achieving the task the controller is loaded with program written using Embedded 'C' Languages. Android smart phone controller Bluetooth robot using microcontroller is shown in fi Application Instructions

3.16 Working Procedure

First make sure your HC-06 Bluetooth module is paired with your mobile. The default password for pairing is "1234" or "0000". Check the manual of Bluetooth module.

4.2 Click on "SELECT DEVICE" icon to select paired Bluetooth module. 4.3 When press "up arrow" it sends the data "A" to Bluetooth module connected with the circuit. When microcontroller detects "A" the robot/robot car moves FORWORD. 4.4 When press "DOWN ARROW" it sends the data "B" to Bluetooth module connected with the circuit. When microcontroller detects "B" the robot/robot car moves REVERSE. 4.5 When press "LEFT ARROW" it sends the data "C" to Bluetooth module connected with the circuit. When microcontroller defects "C" the robot/robot car turns LEFT. 4.6 When press "RIGHT ARROW" it sends the data "D" to Bluetooth module connected with the circuit. When microcontroller defects "D" the robot/robot car turns RIGHT. 4.7 When press "STOP" button which is in the centre of remote it sends the data "E" to the Bluetooth module connected with the circuit. When microcontroller defects "E" the robot/robot car gets stopped 4.8 Click on "DISCONNECT" icon to disconnect paired Bluetooth module.

The objective of the paper is to realise the smart living , more specifically the home lighting control system using Bluetooth Technology. Robot and smartphones are a perfect match, specially mobile robots. As phones and mobile devices are each time more powerful, using them as robot for building robot with advanced feature such as voice recognition. Android bluetooth-enable phones and bluetooth module via HC-06 and communication among bluetooth devices. It is concluded that smart living will gradually turn into areality that consumer can control their home romotely and wirelessly.

3.17 LED

A light-emitting diode (LED) is a two-lead semiconductor light source. It is a p–n junction diode, which emits light when activated. When a suitable voltage is applied to the leads, electrons are able to recombine with electron holes within the device, releasing energy in the form of photons. This effect is called electroluminescence, and the color of the light (corresponding to the energy of the photon) is determined by the energy band gap of the semiconductor.

Features

- Wide detecting scope.
- Fast response and High sensitivity.
- Stable and long life.
- Simple drive circuit.

3.18 Bluetooth Module

This version of the popular Bluetooth uses the HC-05 module. These modems work as a serial (RX/TX) pipe. Any serial stream from 9600 to 115200bps can be passed seamlessly from your computer to your target.

The remote unit can be powered from 3.3V up to 6V for easy battery attachment. All signal pins on the remote unit are 3V-6V tolerant. No level shifting is required. You can directly connect it to a 3.3V/5V microcontroller. You'll need a usb to serial converter to connect it to a computer.

By default, this bluetooth module is set to be on SLAVE mode. But you can reconfigure it with proper AT commands to use it as a MASTER device. In this Arduino Bluetooth Tutorial we will learn how use the HC-05 module for controlling Arduino via Bluetooth

communication. You can watch the following video or read the written tutorial below for more details.

For this tutorial I made two example, controlling the Arduino using a smartphone and controlling the Arduino using a laptop or a PC. In order not to overload this tutorial, in my next tutorial we will learn how we can configure the HC-05 Bluetooth module and make a Bluetooth communication between two separate Arduino Boards as master and slave devices. Before we start with the first example, controlling an Arduino using a smartphone, let's take a closer look at the HC-05 Bluetooth module. Comparing it to the HC-06 module, which can only be set as a Slave, the HC-05 can be set as Master as well which enables making a communication between two separate Arduino Boards. There are several different versions of this this module but I recommend the one that comes on a breakout



Fig 3.10: HC-05 Bluetooth module

board because in that way it's much easier to be connected. The HC-05 module is a Bluetooth SPP (Serial Port Protocol) module, which means it communicates with the Arduino via the Serial Communication.

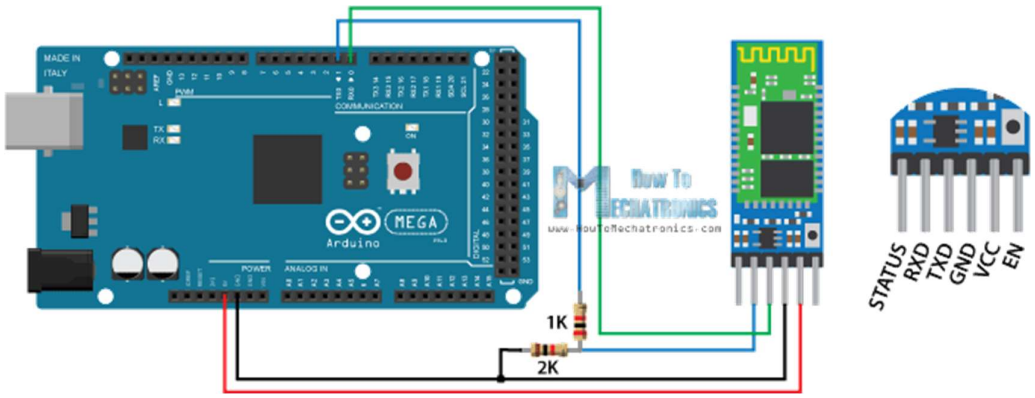


Fig 3.11:Circuit Schematics

The particular module that I have can be powered from 3.6 to 6 volts, because it comes on breakout board which contains a voltage regulator. However, the logic voltage level of the data pins is 3.3V. So, the line between the Arduino TX (Transmit Pin, which has 5V output) and the Bluetooth module RX (Receive Pin, which supports only 3.3V) needs to be connected through a voltage divider in order not to burn the module. On the other hand, the line between the Bluetooth module TX pin and the Arduino RX pin can be connected directly because the 3.3V signal from the Bluetooth module is enough to be accepted as a high logic at the Arduino Board.

3.19 Description

First we need to define the pin to which our LED will be connected and a variable in which we will store the data coming from the smartphone. In the setup section we need to define the LED pin as output and set it low right away. As mention previously, we will use the serial communication so we need to begin the serial communication at 38400 baud rate, which is the default baud rate of the Bluetooth module. In the loop section with the Serial. Available () function we will check whether there is available data in the serial port to be read. This means that when we will send data to the Bluetooth module this statement will be true so then using the Serial.read() function we will read that data and put it into the "state" variable. So if the Arduino receive the character '0' it will turn the LED off and using the Serial. println() function it will send back to the smartphone, via the serial port, the String "LED: OFF". Additionally we will reset the "state" variable to 0 so that the two above lines will be executed only once. Note here that the "state" variable is integer, so when we receive the character '0' that comes from smartphone, the actual value of the integer "state" variable is 48, which corresponds to character '0', according to the ASCII table.. That's why in the "if"

statement we are comparing the “state” variable to a character ‘0’. On the other hand, if the received character is ‘1’, the LED will light up and the String “LED: ON” will be sent back.

Now the code is ready to be uploaded but in order to do that we need to unplug the TX and RX lines because when uploading the Arduino uses the serial communication so the pins RX (digital pin 0) and TX (digital pin1) are busy. We can avoid this step if we use the other TX and RX pins of the Arduino Board, but in that case we will have to use the SoftwareSerial.h library for the serial communication.

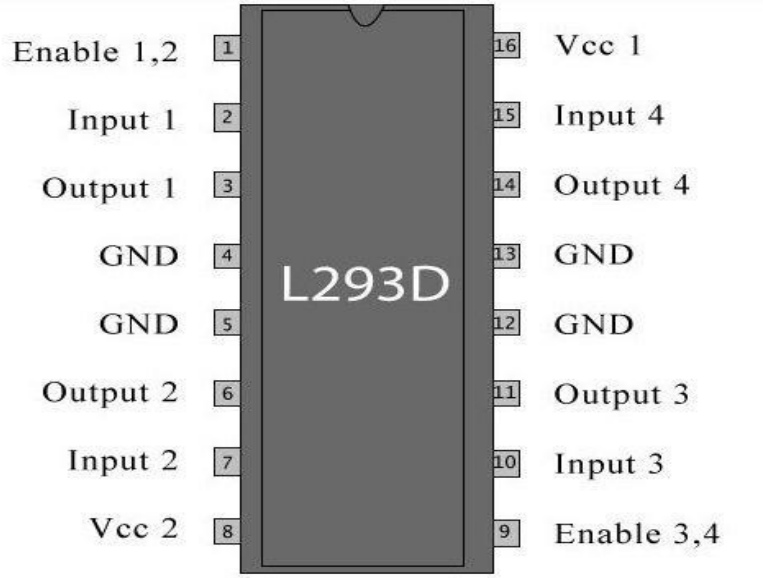


Fig 3.12:Pin No. - Pin Characteristics

Pin No. - Pin Characteristics

- 1 - Enable 1-2, when this is HIGH the left part of the IC will work and when it is low the left part won’t work.
- 2 - INPUT 1, when this pin is HIGH the current will flow though output 1
- 3 - OUTPUT 1, this pin should be connected to one of the terminal of motor
- 4,5 - GND, ground pins 6 - OUTPUT 2, this pin should be connected to one of the terminal of motor
- 7 - INPUT 2, when this pin is HIGH the current will flow though output 2
- 8 - VCC2, this is the voltage which will be supplied to the motor.

- 16 - VCC1, this is the power source to the IC. So, this pin should be supplied with 5v
- 15 - INPUT 4, when this pin is HIGH the current will flow though output 4
- 14 - OUTPUT 4, this pin should be connected to one of the terminal of motor
- 13,12 - GND, ground pins11 - OUTPUT 3, this pin should be connected to one of the terminal of motor
- 10 - INPUT 3, when this pin is HIGH the current will flow though output 3
- 9 - Enable 3-4, when this is HIGH the right part of the IC will work and when it is low the right part won't work.

3.20 Use of 4 grounds in the IC

The motor driver IC deals with heavy currents. Due to so much current flow the IC gets heated. So, we need a heat sink to reduce the heating. Therefore, there are 4 ground pins. When we solder the pins on PCB, we get a huge metallic area between the grounds where the heat can be released.

3.21 Use of Capacitors

The DC motor is an inductive load. So, it develops a back EMF when supplied by a voltage. There can be fluctuations of voltage while using the motor say when suddenly we take a reverse while the motor was moving in some direction. At this point the fluctuation in voltage is quite high and this can damage the IC. Thus, we use four capacitors that help to dampen the extreme variation in current.

Chapter Four

System Model and Result

4.1 System Model and Assumption

Here, the channel 1 provides information about the parameters under the region which is to be monitored for sound and air pollution control. channel 2 deals with the sensor devices with suitable characteristics, features and each of these sensor devices are operated and controlled based on their sensitivity as well as the range of sensing. In between channel 2 and channel 3 necessary sensing and controlling actions will be taken depending upon the conditions, like fixing the threshold value, periodicity of sensing, messages etc. Based on the data analysis performed in between channel 2 and channel 3 and from previous experiences the parameter threshold values during critical situations or normal working conditions are determined. channel 3 describes about the data acquisition from sensor devices and includes the decision making. Which specify the condition the data is representing which parameter. In the proposed model channel 4 deals with the intelligent environment. Which means it will identify the variations in the sensor data and fix the threshold value depending on the identified level of CO or noise levels.

4.2 Wi-Fi Module

The esp8266 WIFI module is a self containedsoc with integrated TCP/IP protocol stack that can give any microcontroller access to your WIFI network. The esp8266 is capable of either hosting an application or offloading all WIFI networking functions from another application processor. The ESP8266 WiFi Module is a self contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your WiFi network. The ESP8266 is capable of either hosting an application or offloading all WiFi networking functions from another application processor. A “single” solution where the MCU runs the WiFi stack and the host application in one chip. A “host processor + WiFi module” solution where the wireless connectivity solution contains the WiFi stack, and a separate processor runs the host application.

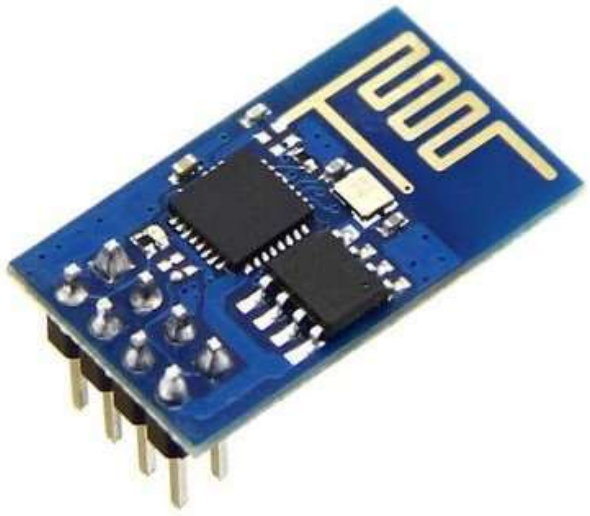


Fig 4.1 Wi-Fi module.

4.3Air Quality Monitoring Sensor

Air quality sensors are devices used to detect contaminants in the air. This includes particulates, pollutants and noxious gases that may be harmful to human health. They are used in applications like air quality monitoring, gas detection in industry, combustion controllers and oxygen generators in aircraft. Air pollution sensors are devices that monitor the presence of air pollution in the surrounding area. They can be used for both indoor and outdoor environments. These sensors can be built at home, or bought from certain manufactures. Although there are various types of air pollution sensors, and some are specialized in certain aspects, the majority focuses on five components: ozone, particulate matter, carbon monoxide, sulfur dioxide, and nitrous oxide. The sensors were very expensive in the past, but with technological advancements these sensors are becoming more affordable and more widespread throughout the population. These sensors can help serve many purposes and help bring attention to environmental issues beyond the scope of the human eye.

The EPA maintains a repository of air quality data through the Air Quality System (AQS) where it stores data from over 10,000 monitors in the United States.

While use of these sensors was expensive in the past, the 2010s saw a recent trend towards the development of cheaper portable air-quality sensors that can be worn by individuals to monitor local air quality levels.These sensors, can then, in turn, help measure the spatiotemporal coverage and variety of chemical species, and empower individuals and communities to better understand their exposure environments and risks from air pollution.

A research group led by William Griswold at UCSD handed out portable air pollution sensors to 16 commuters, and found "urban valleys" where buildings trapped pollution. The group also found that passengers in buses have higher exposures compared to those in automobiles.

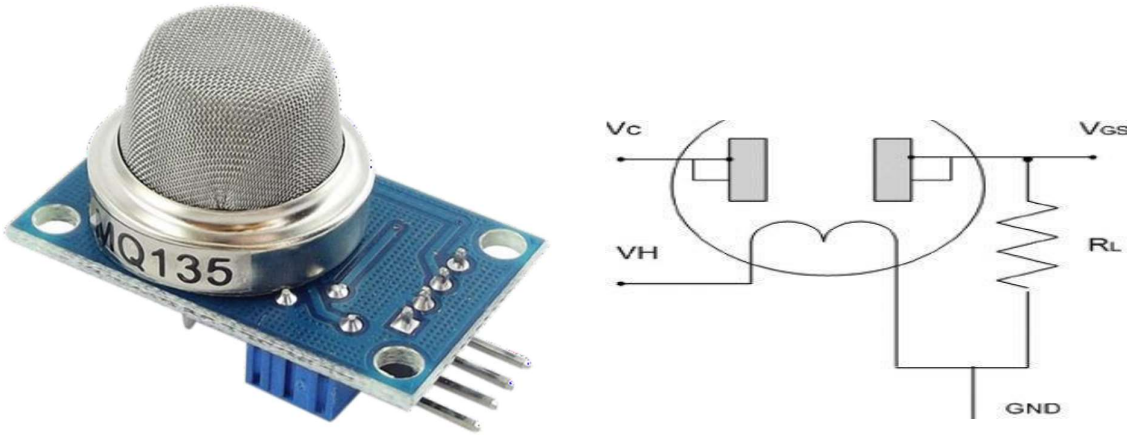


Fig 4.2: Air quality monitoring sensor

4.4 16*2 LCD Display

LCD is used for to display the condition there are three conditions in air pollution and three conditions in noise pollution means air and sound is clear, moderately polluted or highly polluted that is displayed on LED. An LCD (Liquid Crystal Display) screen is an electronic display module and has a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. The 16 x 2 intelligent alphanumeric dot matrix display is capable of displaying 224 different characters and symbols. This LCD has two registers, namely, Command and Data.

Command register stores various commands given to the display. Data register stores data to be displayed. The process of controlling the display involves putting the data that form the image of what you want to display into the data registers, then putting instructions in the instruction register. In your arduino project Liquid Crystal Library simplifies this for you so you don't need to know the low-level instructions. Contrast of the display can be adjusted by adjusting the potentiometer to be connected across VEE pin.

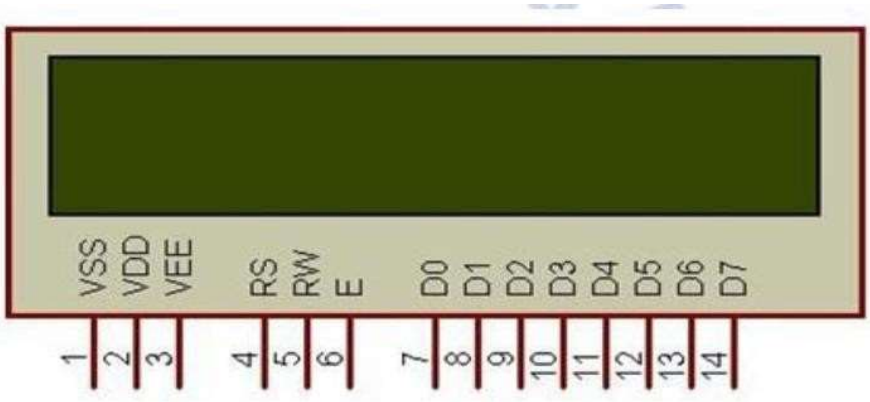


Fig 4.4: LCD Display

4.5 Sound Sensor

The sound sensor module provide an easy way to detect sound and it generally used for detecting sound intensity. Module detect the sound has exceeded a threshold value. Sound is detected via microphone and fed into an LM393 opamp. The sound level adjust through pot. The sound increases set value output is low. These module work on DC 3.3-5 voltage. Sound detection sensor works similarly to our Ears, having diaphragm which converts vibration into signals. However, what's different as that a sound sensor consists of an in-built capacitive microphone, peak detector and an amplifier (LM386, LM393, etc.) that's highly sensitive to sound.

With these components, it allows for the sensor to work: Sound waves propagate through air molecules Such sound waves cause the diaphragm in the microphone to vibrate, resulting in

capacitance change Capacitance change is then amplified and digitalized for processing of sound intensity and it has some applications.

- Apart from building various electronic projects with Arduino (covered in the later section) and more, sound sensors are used in many other day to day applications including:
- Consumer electronics such as phones, computers, music systems Security and Monitoring systems such as burglar alarms, door alarm, etc.
- Home automation such as lighting your house by detecting whistle/clap instead of physically turning the light switch
- Ambient sound recognition and sound level recognition

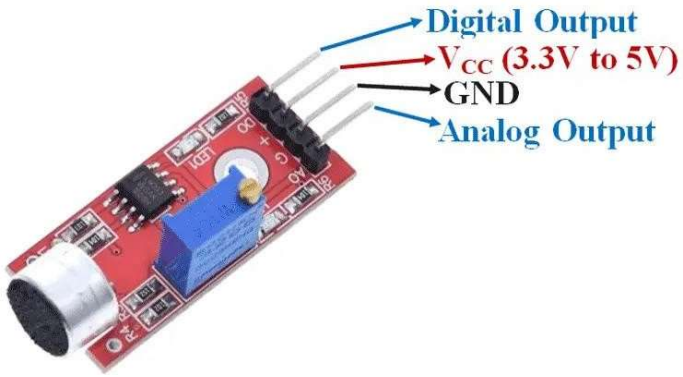
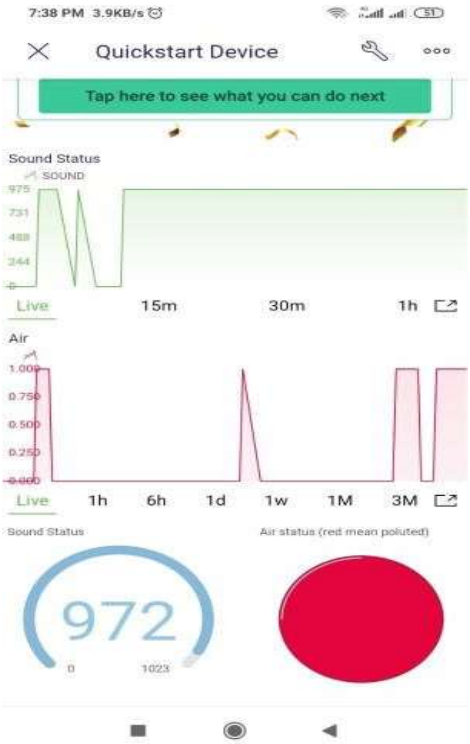


Fig 4.5: Sound Sensor

4.6 Result

The air and sound pollution monitoring system monitors air and noise pollution using a mobile application. It shows the digital value of air and sound pollution and user can analyse it with a graph. It becomes very easy for us to rectify the levels and air and noise pollution around and plan for a healthy living and surrounding. The figures that are included in our paper shows the way the system works and how the output is obtained from the input after processing. The Automatic Air & Sound monitoring management system is a step forward to contribute asolution to the biggest threat. The air & sound monitoring system overcomes the problem of the highly-polluted areas which is a major issue. It supports the new technology and effectively supports the healthy life concept. This system has features for the people to monitor the amount of pollution on their mobile phones using the application.





4.7 Cost of the Project

Sl.no	Particulars	Qty.	Unit Price (Taka)	Total Price (Taka)
1	Arduino Uno	1no.	500	500
3	Air Quality Sensor	1no.	300	300
4	Sound Sensor	1no.	300	300
5	Power Supply	1no.	120	120
6	WiFi Module	1no.	500	500
7	Server	1no	350	700
8	Indicator	1no.	6	20
			Total	2440/=

Table 1: Components and cost of the project.

Chapter Five

Discussion and Conclusion

5.1 Discussion

The Automatic Air & Sound monitoring management system is a step forward to contribute a solution to the biggest threat. The air & sound monitoring system overcomes the problem of the highly- polluted areas which is a major issue. It supports the new technology and effectively supports the healthy life concept. This system has features for the people to monitor the amount of pollution on their mobile phones using the application. So, it becomes very reliable and efficient for the Municipal officials along with the Civilians to monitor environment. Letting civilians also involved in this process adds an extra value to it. As civilians are now equally aware and curious about their environment, this concept of IOT is beneficial for the welfare of the society. And it is implemented using the latest technology. The air and sound pollution monitoring system monitors air and noise pollution using a mobile application. It shows the digital value of air and sound pollution and user can analyse it with a graph. It becomes very easy for us to rectify the levels and air and noise pollution around and plan for a healthy living and surrounding. The figures that are included in our paper shows the way the system works and how the output is obtained from the input after processing.

The increasing air and sound pollution is one of the significant issue now days. As the pollution increasing it is giving rise number of diseases so, it has become essential to control the pollution for better future and healthy life .here we propose an air quality as well as sound pollution monitoring system that allows us to monitor and check live air quality as well as sound pollution monitoring in particular areas through IOT. System uses air sensor to detect or sense presence of harmful gases, compounds in the air and constantly transmit data to microcontroller. Also system keeps measure sound level and report it to the online server over IOT. The user friendly and easy handling of the system technology is such that it can be installed in houses, schools and in small places.

6.2 Conclusions

The main goal of IOT Air & Sound Monitoring System is that the Air and sound pollution is a growing issue these days. It is necessary to monitor air quality and keep it under control for a better future and healthy living for all. Here we propose an air quality as well as sound

pollution monitoring system that allows us to monitor and check live air quality as well as sound pollution in an area through IOT. System uses air sensors to sense presence of harmful gases/compounds in the air and constantly transmit this data. Also, system keeps measuring sound level and reports it. The sensors interact with Arduino and sensors which processes this data and transmits it over the cloud then to the application. This allows authorities to monitor air and sound pollution in different areas and act against it.

6.3 Future Work

In future we modify the system to notify a user about the air quality and noise level it reaches beyond permissible level through sms or app. We can monitor air and sound pollution level at any place of the world.

References

[1] Navreetinder Kaur, Rita Mahajan, Deepak Bagai,“Air Quality Monitoring System based on Arduino Microcontroller,” International Journal Innovative Research in Science, Engineering and Technology (IJIRSET),Vol 5, Issue 6- June 2016.

[2] Shadrach Tunde,Akinkaude, kowawole, Peter Fasae, “A Survey of Noise Pollution in Ado-Ekiti Metropolis Using Mobile Phone,” Science Technology Department, Science Research Publishing, October-2015.

[3] Diego Méndez, Alfredo J. Pérez, Miguel A. Labrador,Juan José Marrón, "P-Sense: A participatory sensing system for air pollution monitoring and control"(Department of Computer Science and Engineering, University of South Florida, Tampa, USA) Published on IEEE at: 12 May 2011 , DOI: 10.1109/PERCOMW.2011.5766902.

[4] Jiong Jin, Jayavardhana Gubbi, Slaven Marusic, Marimuthu Palaniswami, "An Information Framework for Creating a Smart City Through Internet of Things,"Published in: IEEE Internet of Things Journal (Volume: 1, Issue: 2, April 2014)DOI:10.1109/JIOT.2013.22965168.

[5] A. R. Al-Ali, Imran Zualkernan, and Fadi Aloul, “A Mobile GPRS-Sensors Array for Air Pollution Monitoring,” IEEE SENSORS JOURNAL, VOL. 10, NO. 10, OCTOBER 2010.

6] Hsing-I Wang Lin Tuing, “Toward a Green Campus with the Internet of Things – the Application of Lab Management,” Proceedings of the World Congress on Engineering 2013 Vol II, WCE 2013, July 3 - 5, 2013, London, U.K.

[7] Darshana N. Tambe, Netika A. Chavhan, “Evaluation Air Pollution Parameters Using Zigbee (IEEE 802.15.6),”IOSR Journal of Computer Engineering; Vol 11, Issue 4 - May-June 2013.

[8] Anjaiah Guthi,“Implementation of an Efficient Noise and Air Pollution Monitoring System Using Internet of Things,” International Journal of Advanced Research in Computer and Communication Engineering, Vol 5, Issue 7- Jully 2016.

[9] Dr. A. Sumithra, PJ.Jane Ida, PK. Karthika, Dr. S. Gavaskar,“A smart environmental monitoring system using internet of things,” Members, IEEE Vol 3,Issue 3-Oct 2013.

[10]P.Vijnatha Raju, R.V.R.S.Aravind, Sangeeth Kumar,"Pollution Monitoring System using Wireless Sensor Network," International Journal of Engineering Trends and Technology (IJETT),Vol 4, Issue 4 - April 2013.

[11] A. R. Al-Ali, Imran Zualkernan and Fadi Aloul, ―A Mobile GPRS-Sensors Array for Air Pollution Monitoring‖ IEEE SENSORS JOURNAL, VOL. 10, NO. 10, OCTOBER 2010

[12] F. Tsow, E Forzani, A. Rai, R. Wang, R. Tsui, S. Mastroianni, C. Knobbe, A. J. Gandolfi, and N. J. Tao, ―A wearable and wireless sensor system for real-time monitoring of toxic environmental volatile organic compounds, IEEE Sensors J., vol. 9, pp. 1734–1740, Dec. 2009.

[13] Global Warming-Climate 365. (n.d.). Retrieved April 04, 2018, from Google Sites: Sites.google.com/a/climate365.

[14] Hakimi Hydraulics & fittikings. (n.d.). Retrieved from www.hakimihydraulics.com: Krupenkin, T. & Taylor, J. A. (2011). Reverse electrowetting as a new approach to high-power energy harvesting. NATURE COMMUNICATIONS,

[15] Krupenkin, T. & Taylor, J. A. (2011). Reverse electrowetting as a new approach to high-power energy harvesting. NATURE COMMUNICATIONS,

[16] Liddell, H.G. & Scott, R. (1843). A Greek-English Lexiconat the perseus project. Oxford: Oxford University Press.

[17] Magdum, P. R.,Chikhale, S. J., Rajole, A. S., & Jedhe, S. S. (2017). Generation of Electricity by Using Footsteps as a Source of Energy. IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) ,

[18] Pipe fitting-Ss cross Exporter. (n.d.). Retrieved April 2018, 04, from.

[19] Portal:weather/selected Article/6. (19, April 2017). Retrieved from Wikipedia:.Weather/Selected_article/6 13. Sekhar, A., kishore, B., & Raju, T. (2014). Electromagnetic Foot Step Power Generation. International Journal of Scientific and Research Publications, 3027.

Appendix

```
1.  #define ledPin 7
2.  int state = 0;
3.  void setup() {
4.  pinMode(ledPin, OUTPUT);
5.  digitalWrite(ledPin, LOW);
6.  Serial.begin(38400); // Default communication rate of the Bluetooth module
7.  }
8.  void loop() {
9.  if(Serial.available() > 0){ // Checks whether data is comming from the serial port
10. state = Serial.read(); // Reads the data from the serial port
11. }
12. if (state == '0') {
13.     digitalWrite(ledPin, LOW); // Turn LED OFF
14.     Serial.println("LED: OFF"); // Send back, to the phone, the String "LED: ON"
15.     state = 0;
16. }
17.     else if (state == '1') {
18.     digitalWrite(ledPin, HIGH);
19.     Serial.println("LED: ON");;
20.     state = 0;
21. }
```