# Design and Implementation of an Eco-Friendly Smart City

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

**Supervised By**

**Nurul Ambia Alaul**

Lecturer

Department of EEE

Sonargaon University (SU)

**Submitted By**

| | |
|---|---|
| **Md. Sazzad Hossain** | **ID: EEE1903018106** |
| **Md. Swapan Matubbar** | **ID: EEE1903018081** |
| **Md. Mamun Hossain** | **ID: EEE1903018050** |
| **Md. Humayun Kabir Chowdhury** | **ID: EEE1903018089** |
| **Torakul Islam** | **ID: EEE1903018042** |

**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. Sazzad Hossain** | **Md. Humayun Kabir Chowdhury** |
| ..... | …..... |
| **Md. Swapan Matubbar** | **Torakul Islam** |
| ..... | |
| **Md. Mamun Hossain** | |

## Under Supervision of

**.....**

**Nurul Ambia Alaul**

Lecturer

Department of EEE

Sonargaon University (SU)

# Certification

This is to certify that this project entitled “Design and Implementation of an Eco Friendly Smart City” 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

.....

**Nurul Ambia Alaul**

Lecturer

Department of Electrical and Electronic Engineer (EEE)

Sonargaon University (SU)

# ACKNOWLEDGEMENT

The report titled as on "**Design and Implementation of an Eco Friendly Smart City"** 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 **Nurul Ambia Alaul,** Lecturer, 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

Eco frienldy smart city is the most important idea for our present city life. Peoples are so much busy now a days and they need a place where he will live peacefully. In this syste we use here Solar system and Wind syste to generate electricity for daily uses. All the part of this Eco sysem will be controlle automatically. There have a controller to control all the sides of our city. Street lighting is the most important for any area for that reasone we make sure the street lighting properly. In this system street lighting will be turn on when it will be dark at the end of a day, on the other hand, it will be turn off automatically, when it will find the day light. Only car is not profitient for movement for people for that reason we added here Train service also. The Rail line indicator, Rail gate also operated automatically. There have also sound alrming system for notifiye the strengers when it will be the time of train arrive. A eco frindly smart city also decorated by flower gargen and different types of trees for that reason they need to watering in warm season. So we use here automatic watering sysem for flower garden and trees of steet by using sensors. When there have no water will be detected in the garden at that moment water pump will be ON and water will flow for all trees. Solar system is fully automatic, it will move East to West or West to East by following the position of sun. To cotrol water pump and Street light we use here relay module. All the operation will be controlled by Arduino Mega and data will be showing in a LCD. IR sensor will detect the presence of train. So this system is very important for our future generation.

# TABLE OF CONTENTS


| Topics | Page No |
|---|---|
| **DECLARATION** | II |
| **CERTIFICATE** | III |
| **AKNOWLEDGMENT** | IV |
| **ABSTRACT** | V |
| **TABLE OF CONTENTS** | VI |
| **LIST OF FIGURE** | VIII |


# CHAPTER 1: INTRODUCTION


| TOPICS | | Page No. |
|---|---|---|
| 1.1 | Introduction | 01 |
| 1.2 | Objectives | 02 |
| 1.3 | Outline of the project Book | 03 |


# CHAPTER 2: LITERATURE REVIEW


| | | |
|---|---|---|
| 2.1 | Liturature Review | 04 |


# CHAPTER 3: HARDWARE AND SOFTWARE DESCRIPTION


| | | |
|---|---|---|
| 3.1 | SMPS (12V) | 06 |
| 3.2 | Photo Resistor or LDR | 09 |
| 3.3 | Electromagnetic Relay | 10 |
| 3.4 | NPN Silicon Transistors | 11 |
| 3.5 | Arduino Mega | 11 |
| 3.6 | LED’s | 15 |
| 3.7 | Alphanumerical LCD (16×2) | 16 |

| | | |
|---|---|---|
| 3.8 | Solar Panel | 16 |
| 3.9 | Battery Unit | 17 |
| 3.10 | Soil Moisture Sensor | 18 |
| 3.11 | DC water pump | 20 |
| 3.12 | IR Sensor | 21 |
| 3.13 | Servo Motor | 22 |
| 3.14 | Bo Motor | 23 |
| 3.15 | DC Motor | 23 |
| 3.16 | Integrated Development Environment (IDE) | 24 |


# CHAPTER 4: SYSTEM DESIGN


| | | |
|---|---|---|
| 4.1 | Block Diagram | 26 |
| 4.2 | Circuit Diagram | 27 |
| 4.3 | Working Procedure | 28 |


# CHAPTER 5: RESULT & DISCUSSION


| | | |
|---|---|---|
| 5.1 | Hardware Implementation | 29 |
| 5.2 | Calculation | 31 |
| 5.3 | Power Demand for Project Operation | 33 |


# CHAPTER 6: CONCLUSION


| | | |
|---|---|---|
| 6.1 | Advantages | 34 |
| 6.2 | Disadvantages | 34 |
| 6.3 | Limitations | 34 |
| 6.4 | Conclusion | 35 |
| **References** | | 36 |
| **Appendix** | | 38-42 |

# LIST OF FIGURES


| FIGURE NO. | FIGURE NAME | PAGE NO |
|---|---|---|
| 3.1 | SMPS (5V, 5A) | 06 |
| 3.2 | Working Procedure of SMPS (5V, 5A) | 06 |
| 3.3 | Control Unit | 07 |
| 3.4 | Functional Block Diagram of SMPS | 08 |
| 3.5 | Light dependent resistor | 10 |
| 3.6 | Different types of relays | 10 |
| 3.7 | Typical BC 547N NPN silicon transistor | 11 |
| 3.8 | Arduino Mega | 12 |
| 3.9 | Blue, pure green and red LED's in 5 mm diffused cases | 15 |
| 3.10 | 16×2 alphanumeric LCD | 16 |
| 3.11 | Monocrystalline solar panel | 17 |
| 3.12 | Nickel-Cadmium Battery | 18 |
| 3.13 | Soil Moisture Sensor | 18 |
| 3.14 | DC water pump | 20 |
| 3.15 | IR Sensor Module | 21 |
| 3.16 | Servo Motor | 22 |
| 3.17 | Bo Motor | 23 |
| 3.18 | DC Motor | 24 |
| 3.19 | IDE software | 25 |
| 4.1 | Block diagram of the proposed system | 26 |
| 4.2 | Complete circuit diagram of the project | 27 |
| 5.1 | Full over view of proposed system | 29 |

| | | |
|---|---|---|
| 5.2 | Rail gate control system | 29 |
| 5.3 | Soil Moisture sensor with water Pump | 30 |
| 5.4 | Solar and wind power generation system | 30 |
| 5.5 | Street lighting system | 31 |

# Chapter 1

# Introduction

## 1.1 Introduction

Bangladesh is a developing country. According to the Bangladesh Bureau of Statistics, there are 532 urban centers in Bangladesh. The rapid growth of the population in Bangladesh makes the city life more challenging. Every day more and more people are migrating to the cities from rural areas for better livelihood. The management and governance of the cities are becoming harder than before due to the increasing population. In these circumstances, sustainable smart city projects can be a solution for a better urban lifestyle in Bangladesh. The concept of a smart city is fuzzy and inconsistent. The label “smart city” is sometimes replaced with other adjectives like the digital city, eco-city, knowledge city, or intelligent city. Despite its popularity, it is difficult to find a prevalent or universally acknowledged definition of a smart city. Stated by Meijer and Bolı´var , there are three different kinds of ideal-typical definitions of the smart city. They are – technology-focused, human-resource focused (smart people) and governance focused such as smart collaboration among the government and the citizens. V. Fernandez-Anez defined a smart city as a system that interacts with natural and economic resources via technology-based solutions and intensify human and social capital properly. Regarding public engagement, smart cities are divisible into three groups: bottom-up, beneficial, and techno smart cities. Lara et al. defined the smart city as an umbrella concept holding several sub-concepts such as smart technology, smart governance, smart transport system, smart health management, smart economy, smart economy, and so on. The expected outcomes of smart city projects are sustainability, the livability of the citizen, improved quality of life, equity, and resilience. A smart city has some unique characteristics than traditional cities. According to M. Angelidou, a smart city can hold a variety of characteristics based on distinct domains like technology-centric, development of human resource and social status, promoting the entrepreneurs, information security and privacy, adapted strategies, top-down management, networking, an explicit strategic framework, exchange of information, interdisciplinary planning, and general collaboration. The

fundamental characteristics of a smart city are high-speed broadband connection plus quick data management. The strategy that lies beneath a highly effective and demand-responsive smart city project is to create a clever combination and connection between these characteristics and overcome the challenges deliberately. A smart city project requires having a clear concept of sustainable urban development. According to the United Nations, "sustainable development is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs." A recent review study by Yigitcanlar and Kamruzzaman found out that cities need to be sustainable before they become smart. Despite incorporating several dimensions, smart cities cant successfully achieve sustainable goals in practice rather than using technology. A smart city faces difficulties to meet the sustainable goals because of its high-tech requirements, the complexity of practices, and conceptualizing the smart city idea in an ad-hoc manner. T. Yigitcanlar et al found that smart cities practice a genuine and progressive approach that easily reaches a sustainability goal. The study approach dealt with quick practice and policymaking to achieve the set goal of a smart and sustainable city. This study aims to present a conceptual framework for smart cities which is expected to be a major turning point for sustainable development in Bangladesh. The study searches for other successful sustainable smart city models and case studies to create a new framework. The research also recommends the elements which must be met for the smart city initiative in the Bangladeshi context. The outcome of this study provides a conceptual model of a modern smart city for Bangladesh. The model includes the core smart city dimensions and sustainability indicators with the technological backbone. The whole smart city architecture stands on four generic smart city pillars. The new smart city framework shows a proper relationship between the smart city components.

## 1.2 Objectives

The main objectives for this project are to design and construct an Arduino based "ECO Friendly Smart City."

1. To achieve the knowledge of Arduino IDE software, hardware and input output connection.

2. To design Arduino based ECO friendly Smart City.
3. Use of the Arduino is to control the operation of led light, Rail line Signal, Water Pump, Solar tracker servo & Road Signal Lamp.
4. To build a complete model for controlling actual smart City.

## 1.3 Outline of the project Book

This project book is arranged into the following chapters:

Chapter 1 gives a brief introduction to the background of the project, objectives, and report organization.

Chapter 2 focuses about the Literature review of this system

Chapter 3 focuses on the Hardware and of Software Description which is used in this system.

Chapter 4 Concludes the results of the system.

Chapter 6 Concludes the discussion and conclusion of this proposed system.

# Chapter 2

# Literature Review

## 2.1 Literature Review

The Smart City paradigm aims to improve citizens' quality of life in a scenario where the percentage of people living in urban areas is getting higher and higher. In this paper, a new methodological approach is presented to evaluate to what extent the smart cities' development pursues sustainable development goals. This methodology is called Smart inability. The Smart inability approach allows estimating, with qualitative and quantitative indicators, how far smart cities are more sustainable (and smart) in environmental, economical, energetic and social fields, thanks to innovative technologies. Moreover, this estimate can be performed before the technologies deployment. The methodology has been tested on the case study of the Expo Milano 2015 site.

The implementation on the Expo Milano 2015 site, demonstrates that Smart inability methodology is able to give decision makers useful information on benefits generated by smart solutions deployment. This aspect is due to three relevant issues: benefits are expressed with quantitative indicators; indicators are estimated before technologies or solutions implementation; benefits are connected to technologies or solutions deployment. A solar cell is a device which converts light energy to electrical energy through photovoltaic effect. Solar cells are the building blocks of photovoltaic modules known as solar panels. In solar tracking system, the module's surface tracks the position of the sun automatically as the day runs by. The position of the sun varies as the sun moves across the sky. For a solar powered equipment to work best, it must be placed near the sun and the solar tracker can increase the efficiency of that equipment at any fixed position. Based on sophistication, costs and performance. One common type of tracker is the heliostat, a movable mirror that reflects the position of the sun to a fixed location. A solar trackers accuracy depends on the application. Concentrators, especially in solar cell applications, require a high degree of accuracy to make sure that the concentrated sunlight is directed exactly to the powered device, which is close to the focal point of the reflector or lens. Without tracking, concentrator systems will not work at all, therefore single-axis tracking is mandatory. Non-concentrating applications require less accuracy,

and many are likely to work without any tracking. However, tracking with great effect can improve both the amount of total output power produced by a system and that produced during critical system demand periods (usually late afternoon in hot climates). Researches have been done to improve the energy production of solar panels. These researches include; double-sided panels, conversion stages improvement, building panels integration geometrically and so on. Maximum energy is produced by a solar PV panel when it is positioned at right angle to the sun. For this reason, several researches developed different types of solar panel tracking systems. Therefore, the primary purpose of this work is to develop a solar panel tracker based on Arduino advances so as to enhance the energy production of solar panel. The solar tracking system comprises of a solar panel, Arduino microcontroller and sensors. For this system to operate there must be emission of light through the sun. The LDRs serve as the sensors to detect the intensity of light entering the solar panels. The LDR then sends information to the Arduino microcontroller. The servo motor circuit is then constructed. The servo has 3 pins of which the positive side is connected to the +5V of the arduino microcontroller. The negative of the servo is connected to the ground. The data point on the servo is connected to the analog point on the microcontroller. A potentiometer is connected so as to regulate the speed of the servo motor. The block and the flow chart diagrams of the tracking system are shown in figure 1 and 2.

# Chapter 3

# Hardware and Software Description

## 3.1 SMPS (12V)

L7805CV The disadvantages of LPS such as lower efficiency, the need for large value of capacitors to reduce ripples and heavy and costly transformers etc. are overcome by the implementation of Switched Mode Power Supplies.

The working of SMPS is simply understood by knowing that the transistor used in LPS is used to control the voltage drop while the transistor in SMPS is used as a controlled switch.



Figure 3.1: SMPS (5V, 5A)

Working:

The working of SMPS can be understood by the following figure.

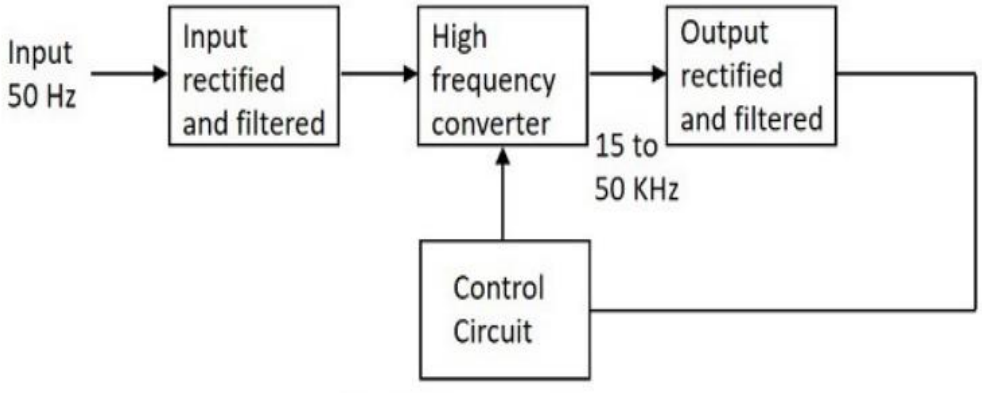



Figure 3.2: Working Procedure of SMPS (5V, 5A)

Let us try to understand what happens at each stage of SMPS circuit.

Input Stage

The AC input supply signal 50 Hz is given directly to the rectifier and filter circuit combination without using any transformer. This output will have many variations and the capacitance value of the capacitor should be higher to handle the input fluctuations. This unregulated dc is given to the central switching section of SMPS.

Switching Section

A fast switching device such as a Power transistor or a MOSFET is employed in this section, which switches ON and OFF according to the variations and this output is given to the primary of the transformer present in this section. The transformer used here are much smaller and lighter ones unlike the ones used for 60 Hz supply. These are much efficient and hence the power conversion ratio is higher.

Output Stage

The output signal from the switching section is again rectified and filtered, to get the required DC voltage. This is a regulated output voltage which is then given to the control circuit, which is a feedback circuit. The final output is obtained after considering the feedback signal.

Control Unit

This unit is the feedback circuit which has many sections. Let us have a clear understanding about this from the following figure.

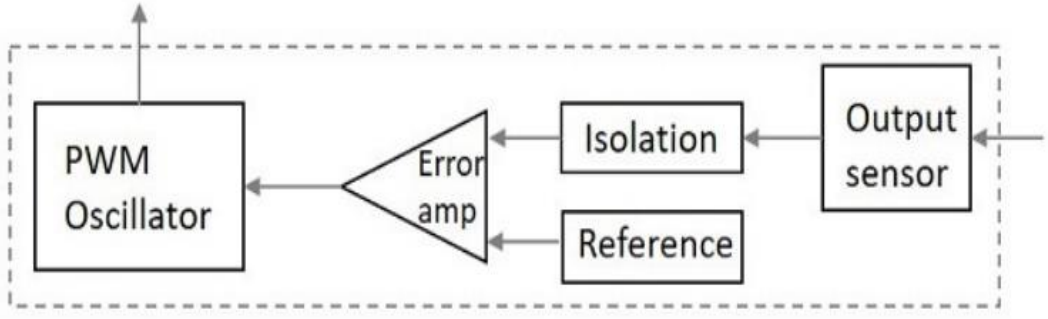



Figure 3.3: Control Unit

The above figure explains the inner parts of a control unit. The output sensor senses the signal and joins it to the control unit. The signal is isolated from the other section so that any sudden spikes should not affect the circuitry. A reference voltage is given as one input along with the signal to the error amplifier which is a comparator that compares the signal with the required signal level.

By controlling the chopping frequency the final voltage level is maintained. This is controlled by comparing the inputs given to the error amplifier, whose output helps to decide whether to increase or decrease the chopping frequency. The PWM oscillator produces a standard PWM wave fixed frequency.

We can get a better idea on the complete functioning of SMPS by having a look at the following figure.

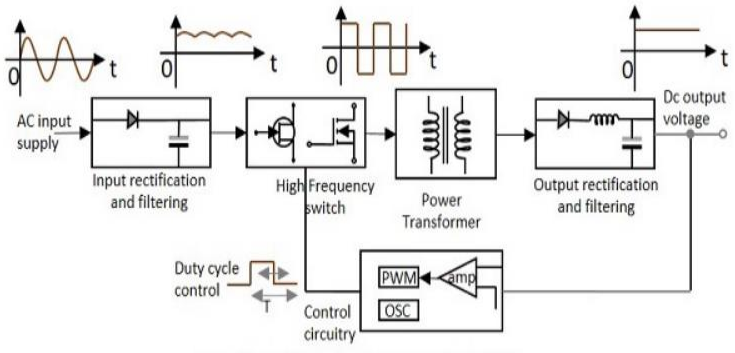



Figure 3.4: Functional Block Diagram of SMPS

The SMPS is mostly used where switching of voltages is not at all a problem and where efficiency of the system really matters. There are few points which are to be noted regarding SMPS. They are

- SMPS circuit is operated by switching and hence the voltages vary continuously.
- The switching device is operated in saturation or cut off mode.
- The output voltage is controlled by the switching time of the feedback circuitry.
- Switching time is adjusted by adjusting the duty cycle.
- The efficiency of SMPS is high because, instead of dissipating excess power as heat, it continuously switches its input to control the output.

**Disadvantages**

There are few disadvantages in SMPS, such as

- The noise is present due to high frequency switching.
- The circuit is complex.
- It produces electromagnetic interference.

**Advantages**

The advantages of SMPS include,

- The efficiency is as high as 80 to 90%
- Less heat generation; less power wastage.
- Reduced harmonic feedback into the supply mains.
- The device is compact and small in size.
- The manufacturing cost is reduced.
- Provision for providing the required number of voltages.

**Applications**

There are many applications of SMPS. They are used in the motherboard of computers, mobile phone chargers, HVDC measurements, battery chargers, central power distribution, motor vehicles, consumer electronics, laptops, security systems, space stations, etc.

## 3.2 Photo Resistor or LDR

A Light dependent resistor (LDR) is resistor whose resistance decreases with increasing incident light intensity; in other words, it exhibits photoconductivity. We are using LDR as another input to the controller. A photo-resistor is made of a high resistance semiconductor. If light falling on the device is of high enough frequency, photons absorbed by the semiconductor give bound electrons enough energy to jump into the conduction band. The resulting free electron (and its hole partner) conduct electricity, thereby lowering resistance.

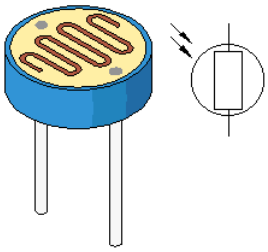


Figure 3.5: Light dependent resistor.

A photoelectric device can be either intrinsic or extrinsic. An intrinsic semiconductor has its own charge carriers and is not an efficient semiconductor, for example, silicon. In intrinsic devices the only available electrons are in the valence band, and hence the photon must have enough energy to excite the electron across the entire band gap. Extrinsic devices have impurities, also called do pants, and added whose ground state energy is closer to the conduction band; since the electrons do not have as far to jump, lower energy photons (that is, longer wavelengths and lower frequencies) are sufficient to trigger the device. If a sample of silicon has some of its atoms replaced by phosphorus atoms (impurities), there will be extra electrons available for conduction. This is an example of an extrinsic semiconductor.

## 3.3 Electromagnetic Relay

Relays are remote control electrical switches that are controlled by another switch, such as a horn switch or a computer as in a power train control module. Relays allow a small current flow circuit to control a higher current circuit. Several designs of relays are in use today, 3-pin, 4-pin, 5-pin, and 6- pin, single switch or dual switches. Relays which come in various sizes, ratings, and applications, are used as remote control switches. Figure 2.3 shows different types of relays. In this paper, the 5-pin relay will be used.

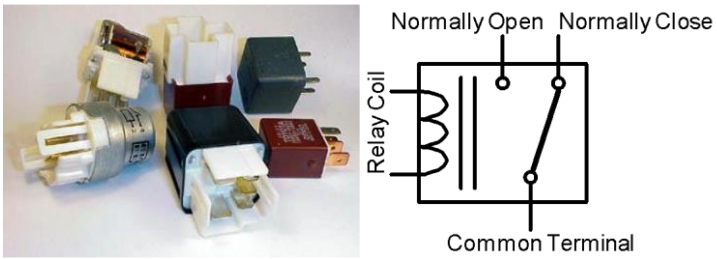



Figure 3.6: Different types of relays.

## 3.4 NPN Silicon Transistors

In our project we have used BC 547N NPN Silicon Transistor, which is a highly performance switching device. Its Collector-Base Voltage is 50 V, maximum, collector to emitter voltage is 45 v maximum, Emitter to base voltage is 5 V, collector current is 100 mA, when input signal is zero, maximum collector power dissipation is 500 m watt. Its switching frequency is 300 MHz. A typical BC 547N NPN Silicon Transistor is shown in the following Figure 3.5.

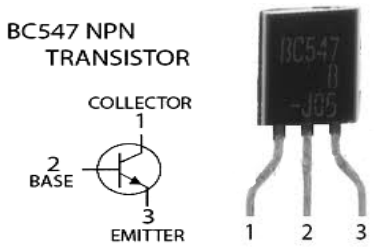



Figure 3.7: Typical BC 547N NPN silicon transistor

## 3.5 Arduino Mega

The Arduino Mega 2560 is a microcontroller board based on the ATmega2560 (datasheet). The Arduino MEGA 2560 is designed for projects that require more I/O lines, more sketch memory and more RAM. With 54 digital I/O pins, 16 analog inputs and a larger space for your sketch it is the recommended board for 3D printers and robotics projects. This gives your projects plenty of room and opportunities maintaining the simplicity and effectiveness of the Arduino platform. This document explains how to connect your Mega2560 board to the computer and upload your first sketch.

It has 54 digital input/output pins (of which 14 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, 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 aAC to DC adapter or battery to get started. The Mega is compatible with most shields designed for the ArduinoDuemilanove or Diecimila.

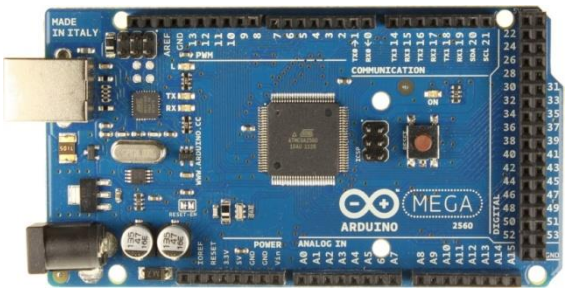



Figure 3.8: Arduino Mega

Features:

- High Endurance Non-volatile Memory Segments
- Atmel QTouch library support
- JTAG (IEEE std. 1149.1 compliant) interface
- Real-time Counter with Separate Oscillator
- Programmable Watchdog Timer with Separate On-chip Oscillator
- On-chip Analog Comparator
- Interrupt and Wake-up on Pin Charge
- Power-on Reset and Programmable Brown-out Detection
- Internal Calibrated Oscillator
- External and Internal Interrupt Sources
- Six Sleep Modes: Idle, ADC Noise Reduction, Power-save, Power-down, Standby, and Extended Standby

**Programming**

The Mega 2560 board can be programmed with the Arduino Software (IDE). For details, see the reference and tutorials.

The ATmega2560 on the Mega 2560 comes preprogrammed with a bootloader that allows you to upload new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol (reference, C header files).

You can also bypass the bootloader and program the microcontroller through the ICSP (In-Circuit Serial Programming) header using Arduino ISP or similar; see these instructions for details.

The ATmega16U2 (or 8U2 in the rev1 and rev2 boards) firmware source code is available in theArduino repository. The ATmega16U2/8U2 is loaded with a DFU bootloader, which can be activated by:

On Rev1 boards: connecting the solder jumper on the back of the board (near the map of Italy) and then resetting the 8U2.
On Rev2 or later boards: there is a resistor that pulling the 8U2/16U2 HWB line to ground, making it easier to put into DFU mode. You can then use Atmel's FLIP software (Windows) or the DFU programmer (Mac OS X and Linux) to load a new firmware. Or you can use the ISP header with an external programmer (overwriting the DFU bootloader). See this user-contributed tutorial for more information.

**Power**

The Mega 2560 can be powered via the USB connection or with an external power supply. The power source is selected automatically.

External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the GND and Vin pin headers of the POWER connector.

The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may become unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts.

The power pins are as follows:

Vin. The input voltage to the board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.

5V. This pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7 - 12V), the USB connector (5V), or the VIN pin of the board (7-12V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage your board. We don't advise it.

3V3. A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA.

GND. Ground pins.

IOREF. This pin on the board provides the voltage reference with which the microcontroller operates. A properly configured shield can read the IOREF pin voltage and select the appropriate power source or enable voltage translators on the outputs for working with the 5V or 3.3V.

**Automatic (Software) Reset**

Rather then requiring a physical press of the reset button before an upload, the Mega 2560 is designed in a way that allows it to be reset by software running on a connected computer. One of the hardware flow control lines (DTR) of the ATmega8U2 is connected to the reset line of the ATmega2560 via a 100 nanofarad capacitor. When this line is asserted (taken low), the reset line drops long enough to reset the chip. The Arduino Software (IDE) uses this capability to allow you to upload code by simply pressing the upload button in the Arduino environment. This means that the bootloader can have a shorter timeout, as the lowering of DTR can be well-coordinated with the start of the upload.

This setup has other implications. When the Mega 2560 board is connected to either a computer running Mac OS X or Linux, it resets each time a connection is made to it from software (via USB). For the following half-second or so, the bootloader is running on the

ATMega2560. While it is programmed to ignore malformed data (i.e. anything besides an upload of new code), it will intercept the first few bytes of data sent to the board after a connection is opened. If a sketch running on the board receives one-time configuration or other data when it first starts, make sure that the software with which it communicates waits a second after opening the connection and before sending this data.

The Mega 2560 board contains a trace that can be cut to disable the auto-reset. The pads on either side of the trace can be soldered together to re-enable it. It's labeled "RESET-EN". You may also be able to disable the auto-reset by connecting a 110 ohm resistor from 5V to the reset line; see this forum thread for details.

## 3.6 LED's

TheStands for "Light-Emitting Diode" and LED is an electronic device that emits light when an electrical current is passed through it. Early LED's produced only red light, but modern LED's can produce several different colors, including red, green, and blue (RGB) light. Recent advances in LED technology have made it possible for LED's to produce white light as well.

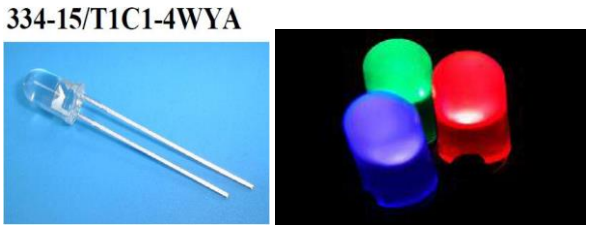



Figure 3.9: Blue, pure green and red LED's in 5 mm diffused cases

Features

- Extra high radiant power and radiant intensity
- High reliability
- Low forward voltage
- Suitable for high pulse current operation
- Standard T–1(ø 5 mm) package
- Angle of half intensity j = ± 10

- Peak wavelength p = 940 n

## 3.7 Alphanumerical LCD (16×2)

TheLCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16×2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LED's. The reasons being: CDs are economical; easily programmable; have no limitation of displaying special and even custom characters (unlike in seven segments), animations and so on. A 16×2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5×7 pixel matrix.



Figure 3.10: 16×2 alphanumeric LCD

## 3.8 Solar Panel

TheMonocrystalline solar panels get their name from how they are made. Each of the individual solar cells contains a silicon wafer that is made of a single crystal of silicon. The single crystal is formed using the Czochralski method, in which a 'seed' crystal is placed into a vat of molten pure silicon at a high temperature. The seed is then drawn up and the molten silicon forms around it, creating one crystal. The large crystal, also called an ingot, is then sliced into thin wafers that are used to make the solar cells. Usually, a monocrystalline panel will contain either 60 or 72 solar cells, depending on the size of the panel. Most residential installations use 60-cell monocrystalline silicon panels.

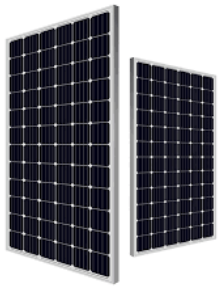


Figure 3.11: Monocrystalline solar panel

Monocrystalline solar panels usually have the highest efficiency and power capacity out of all types of solar panels. Monocrystalline panel efficiencies can range from 17% to 22%. Because monocrystalline solar cells are made out of a single crystal of silicon, electrons are able to flow easier through the cell, which makes the PV cell efficiency higher than other types of solar panels. The higher efficiency of monocrystalline solar panels means that they require less space to reach a given power capacity. So, monocrystalline solar panels will usually have a higher power output rating than either polycrystalline or thin film modules.

In other words, we would need less monocrystalline solar panels in our solar power system to generate the same amount of power that, say, a greater number of polycrystalline solar panels would. This makes monocrystalline solar panels ideal for people with limited roof space.

## 3.9 Battery Unit

A battery is a device capable of storing electrical energy by means of a reversible chemical reaction. There are several different types of battery. They are classified by size, utility and construction. The most common battery is the lead-acid battery. But nickel-cadmium, nickel-iron and nickel-hydride are also available and important. Rechargeable batteries tend to have a lower start voltage and shorter usage cycle; however, they make up the difference by being reusable.




Figure 3.12: Nickel-Cadmium Battery

They are lighter in weight than alkaline batteries. Ni-Cd batteries are the most popular type of rechargeable battery. They are quick to charge and work well in extreme temperatures. They will last up to 500-700 charge/discharge cycles. Ni-Cd batteries can suffer from what is called the "memory effect". If a Ni-Cd battery is recharged before it is fully discharged, the recharge process can create a layer of bubbles in the battery which will eventually prevent the battery from discharging beyond that point. To avoid this problem, it is recommended that Ni-Cd batteries be fully discharged before recharging**.**

## 3.10 Soil Moisture Sensor

A The Soil moisture sensor unit consists of soil moisture sensor and LM393 comparator chip. The soil moisture sensor is used to detect the soil moisture. The soil probe is dip in to the soil such that when the soil moisture is LOW the module output is HIGH indicated by using RED led on the comparator chip. This sensor measures the dielectric constant of the soil by using transmission line techniques.

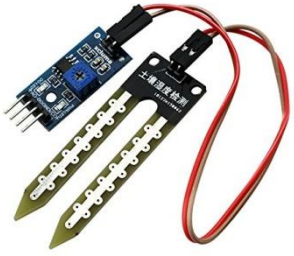


Figure 3.13: Soil Moisture Sensor

This circuit consists of four pins such as power supply pin, ground pin, analog and digital pins. The analog pin A0 connected to the analog pin of ARDUINO board and digital D0 pin connected to the digital pin of ARDUINO board. This sensor is a dual output mode in which analog output is more accurate. The operating voltage is up to 5V.

**Applications of soil sensor**

**Agriculture**

Measuring soil moisture is important for agricultural applications to help farmers manage their irrigation systems more efficiently. Knowing the exact soil moisture conditions on their fields, not only are farmers able to generally use less water to grow a crop, they are also able to increase yields and the quality of the crop by improved management of soil moisture during critical plant growth stages.

**Landscape irrigation**

In urban and suburban areas, landscapes and residential lawns are using soil moisture sensors to interface with an irrigation controller. Connecting a soil moisture sensor to a simple irrigation clock will convert it into a "smart" irrigation controller that prevents irrigation cycles when the soil is already wet, e.g. following a recent rainfall event.

Golf courses are using soil moisture sensors to increase the efficiency of their irrigation systems to prevent over-watering and leaching of fertilizers and other chemicals into the ground.

**Simple sensors for gardeners**

Relatively cheap and simple devices that do not require a power source are available for checking whether plants have sufficient moisture to thrive. After inserting a probe into the soil for approximately 60 seconds, a meter indicates if the soil is too dry, moist or wet for plants.

## 3.11 DC water pump

The pumping of water is a basic and practical technique, far more practical than scooping it up with one's hands or lifting it in a hand-held bucket. This is true whether the water is drawn from a fresh source, moved to a needed location, purified, or used for irrigation, washing, or sewage treatment, or for evacuating water from an undesirable location. Regardless of the outcome, the energy required to pump water is an extremely demanding component of water consumption. All other processes depend or benefit either from water descending from a higher elevation or some pressurized plumbing system.

The ancient concept of the aqueduct took simple and eloquent advantage of maintaining elevation of water for as long and far a distance as possible. Thus, as water moves over great distances, it retains a larger component of its potential energy by spending small portions of this energy flowing down a slight gradation. A useful aqueduct system ultimately depends on a fresh water source existing at a higher elevation than the location where the water can be of use. Gravity does all the work. In all other instances, pumps are necessary.



Figure 3.14: DC Water Pump

In day-to-day situations, available water is often contaminated, unhealthy, or even naturally poisonous, so that it is necessary to pump potable water from lower levels to higher levels, where it can be of use. A fresh water source in a lower stream, river, pond, or lake is often pumped to higher ground for irrigation, livestock, cooking, cleaning or other uses by humans, who quite naturally need fresh water. This will purify mostly fresh water, and the treatment of largely contaminated water refer endlessly to pumping.

## 3.12 IR Sensor

The IR sensor or infrared sensor is one kind of electronic component, used to detect specific characteristics in its surroundings through emitting or detecting IR radiation. These sensors can also be used to detect or measure the heat of a target and its motion. In many electronic devices, the IR sensor circuit is a very essential module. This kind of sensor is similar to human's visionary senses to detect obstacles.

The sensor which simply measures IR radiation instead of emitting is called PIR or passive infrared. Generally in the IR spectrum, the radiation of all the targets radiation and some kind of thermal radiation are not visible to the eyes but can be sensed through IR sensors. In this sensor, an IR LED is used as an emitter whereas the photodiode is used as a detector. Once an infrared light drops on the photodiode, the output voltage & resistance will be changed in proportion to the received IR light magnitude.

The IR sensor module includes five essential parts like IR Tx, Rx, Operational amplifier, trimmer pot (variable resistor) & output LED. The pin configuration of the IR sensor module is discussed below.




Figure 3.15: IR Sensor Module

- VCC Pin is power supply input
- GND Pin is power supply ground

- OUT is an active-high o/p

The main **specifications and features of the IR sensor** module include the following.

- The operating voltage is 5VDC
- I/O pins – 3.3V & 5V
- Mounting hole
- The range is up to 20 centimeters
- The supply current is 20mA
- The range of sensing is adjustable
- Fixed ambient light sensor

## 3.13 Servo Motor

A servo motor is a type of motor that can rotate with great precision. Normally this type of motor consists of a control circuit that provides feedback on the current position of the motor shaft, this feedback allows the servo motors to rotate with great precision. If you want to rotate an object at some specific angles or distance, then you use a servo motor. It is just made up of a simple motor which runs through a servo mechanism. If motor is powered by a DC power supply then it is called DC servo motor, and if it is AC-powered motor then it is called AC servo motor. For this tutorial, we will be discussing only about the DC servo motor working. Apart from these major classifications, there are many other types of servo motors based on the type of gear arrangement and operating characteristics. A servo motor usually comes with a gear arrangement that allows us to get a very high torque servo motor in small and lightweight packages. Due to these features, they are being used in many applications like toy car, RC helicopters and planes, Robotics, etc.




Figure 3.16: Servo Motor

Servo motors are rated in kg/cm (kilogram per centimeter) most hobby servo motors are rated at 3kg/cm or 6kg/cm or 12kg/cm. This kg/cm tells you how much weight your servo motor can lift at a particular distance. For example: A 6kg/cm Servo motor should be able to lift 6kg if the load is suspended 1cm away from the motors shaft, the greater the distance the lesser the weight carrying capacity. The position of a servo motor is decided by electrical pulse and its circuitry is placed beside the motor.

## 3.14 Bo Motor

The Bo motor (Battery Operated) lightweight DC geared motor which gives good torque and rpm at lower voltages. Here you can get bo motor with varying rated speed. This motor can run at approximately 200 rpm when driven by a single Li-Ion cell. Great for battery operated lightweight robots.



Figure 3.17: BO Motor

## 3.15 DC Motor

A DC motor is any of a class of rotary electrical motors that converts direct current (DC) electrical energy into mechanical energy. The most common types rely on the forces produced by induced magnetic fields due to flowing current in the coil. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current in part of the motor.




Figure 3.18: DC Motor

DC motors were the first form of motors widely used, as they could be powered from existing direct-current lighting power distribution systems. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings. Small DC motors are used in tools, toys, and appliances. The universal motor, a lightweight brushed motor used for portable power tools and appliances can operate on direct current and alternating current. Larger DC motors are currently used in propulsion of electric vehicles, elevator and hoists, and in drives for steel rolling mills. The advent of power electronics has made replacement of DC motors with AC motors possible in many applications.

## 3.16 Integrated Development Environment (IDE)

The Arduino integrated development environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in the programming language Java. It originated from the IDE for the languages Processing and Wiring. It includes a code editor with features such as text cutting and pasting, searching and replacing text, automatic indenting, brace matching, and syntax highlighting, and provides simple one-click mechanisms to compile and upload programs to an Arduino board. It also contains a message area, a text console, a toolbar with buttons for common functions and a

hierarchy of operation menus. The source code for the IDE is released under the GNU General Public License, version 2.

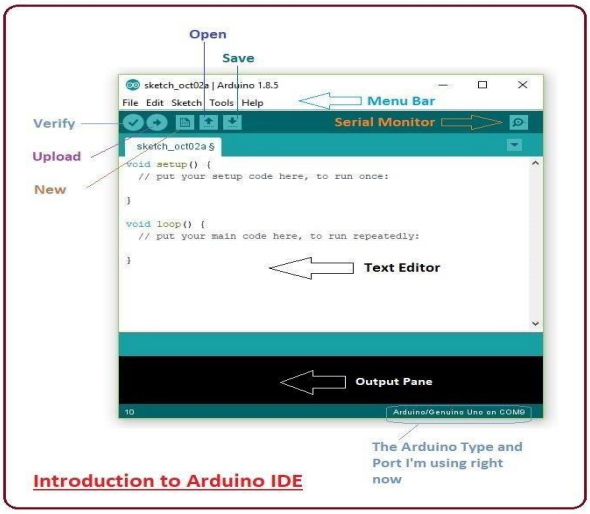



Figure 3.19: IDE software

The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub main() into an executable cyclic executive program with the GNU tool chain, also included with the IDE distribution. The Arduino IDE employs the program AVR dude to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware.

# Chapter 4

# System Design

## 4.1 Block Diagram

In this chapter, we are going to explain the system design construction through hardware and development of software. In addition, the chapter elaborates on the hardware and the software stage by stage. All the operations of hardware and software are also included in this chapter. The system design of the total project is shown in below figure 3.1 with a simple block diagram.

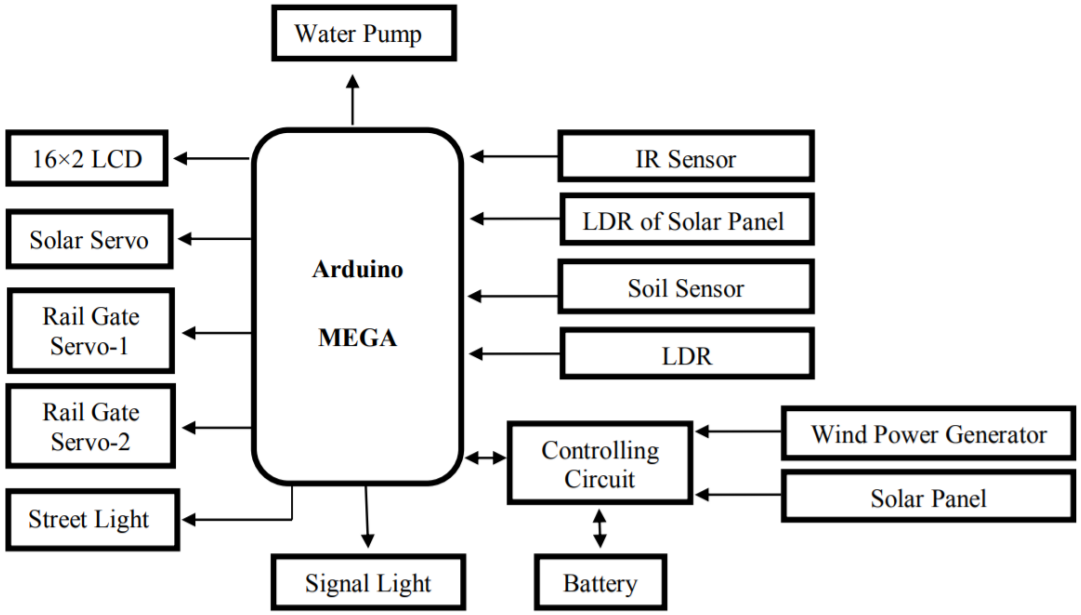



Figure 4.1: Block diagram of the proposed system

The sensors basically will be the input that will be triggered the controller to control the system by certain conditions or programming. The controller is set to decide how the output will be produced from the input conditions. As the system requires the use of Arduino, the design consists of two parts, hardware, and software. Hardware is constructed and integrated module by module, hardware to software for easy troubleshooting and testing.

## 4.2 Circuit Diagram

In this part of this book we attached here full circuit diagram of this proposed system. Here we use proteous simulation software to design this circuit diagram which version is Proteous 8.0.

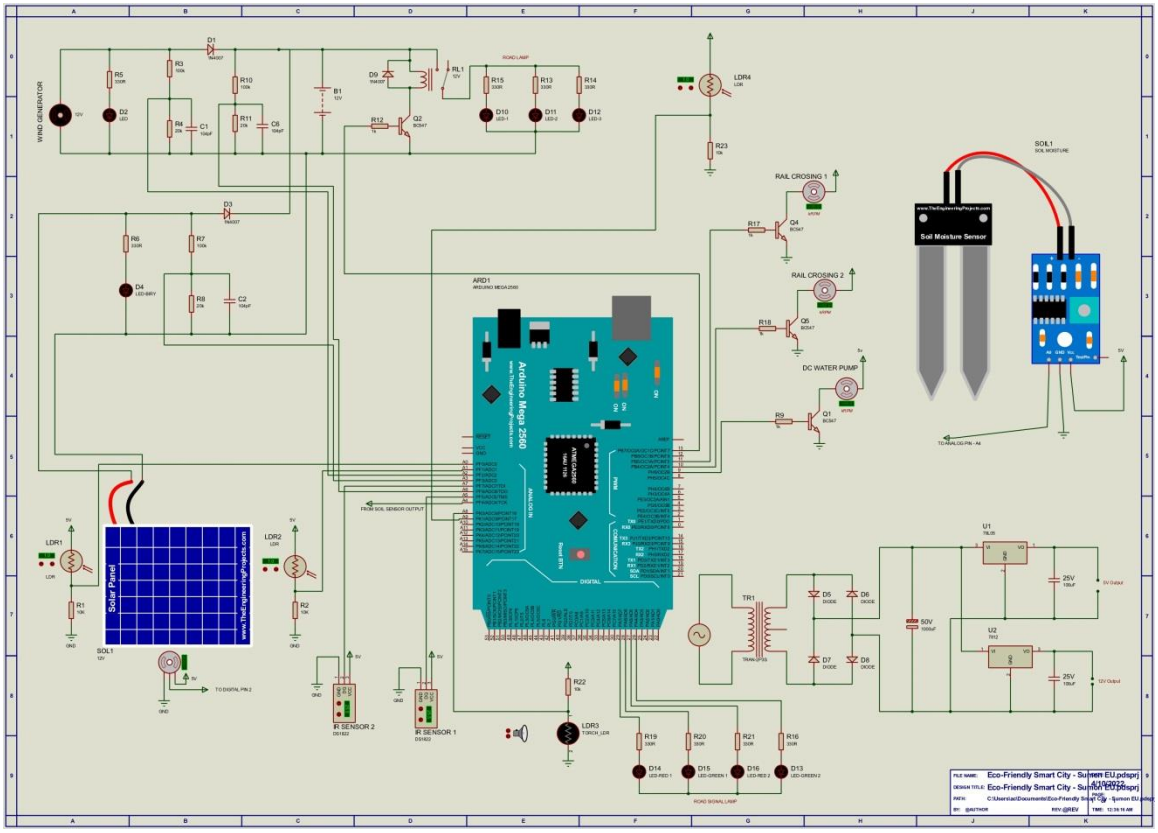



Figure 4.2: Complete circuit diagram of the project.

In this system, we make ac to dc converter to make sure the supply voltage for this system. Here arduino is the main part of this sytem. Solar panel will provide the voltage to operate our treet light and other loads also. This solar system is an automatic solar tracking system included. Here we use wind power system to generate the power for our system. This system includes rail gate controlling sytem using IR sensor.

## 4.3 Working Procedure

The inputs in this Eco-friendly smart city system are different and there outcome also different. We use here two dc power generation sources one is solar panel and another is wind power generator. Here this solar panel will be working as follow as theory of automatic solar tracking system. We use this both power generation system to fulfill the required electricity of our city. Here we use rail crossing signal control system to operate all the signals in our city will be operated automatically and indicator light also.

streets lighting system are controlled by LDR with the presence and absence of day light. When it will be night time all the lights of road will be turn on automatically and when It will be day time then all the lamp will be turn of automatically. So no need to generate this all system in manually. We use here soil moisture sensor to watering system for road side or middle trees.

# Chapter 5

# Result and Discussion

## 5.1 Hardware Implementation

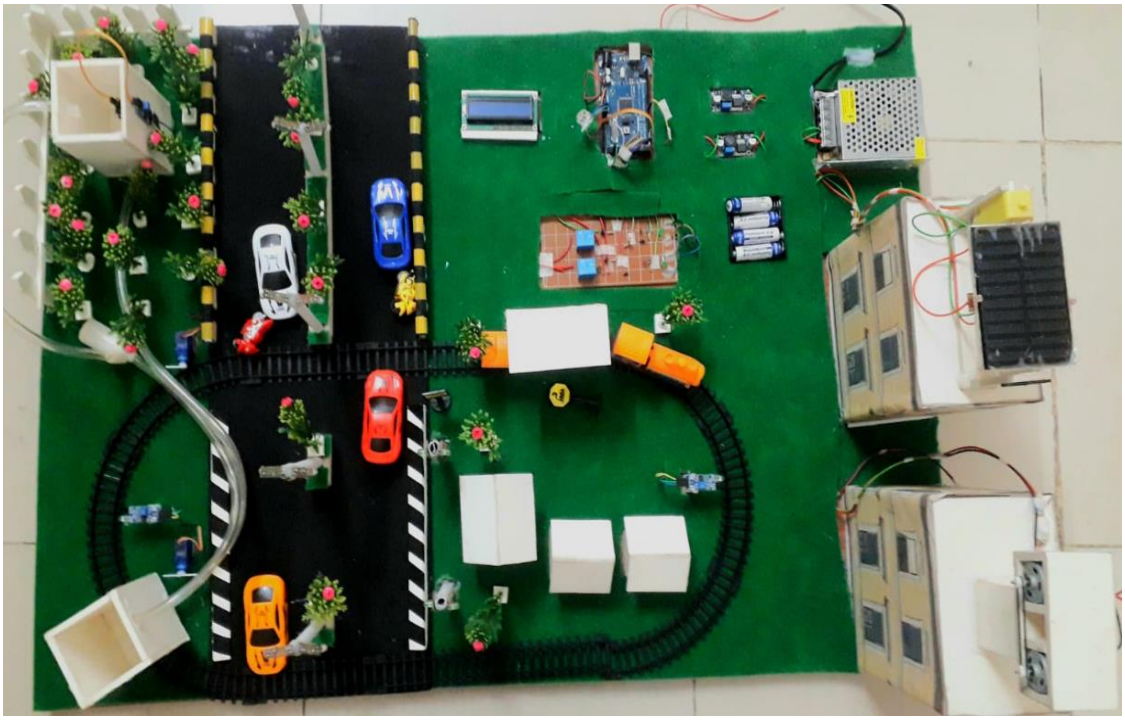


Figure 5.1: Full over view of proposed system.



Figure 5.2: Rail gate control system.

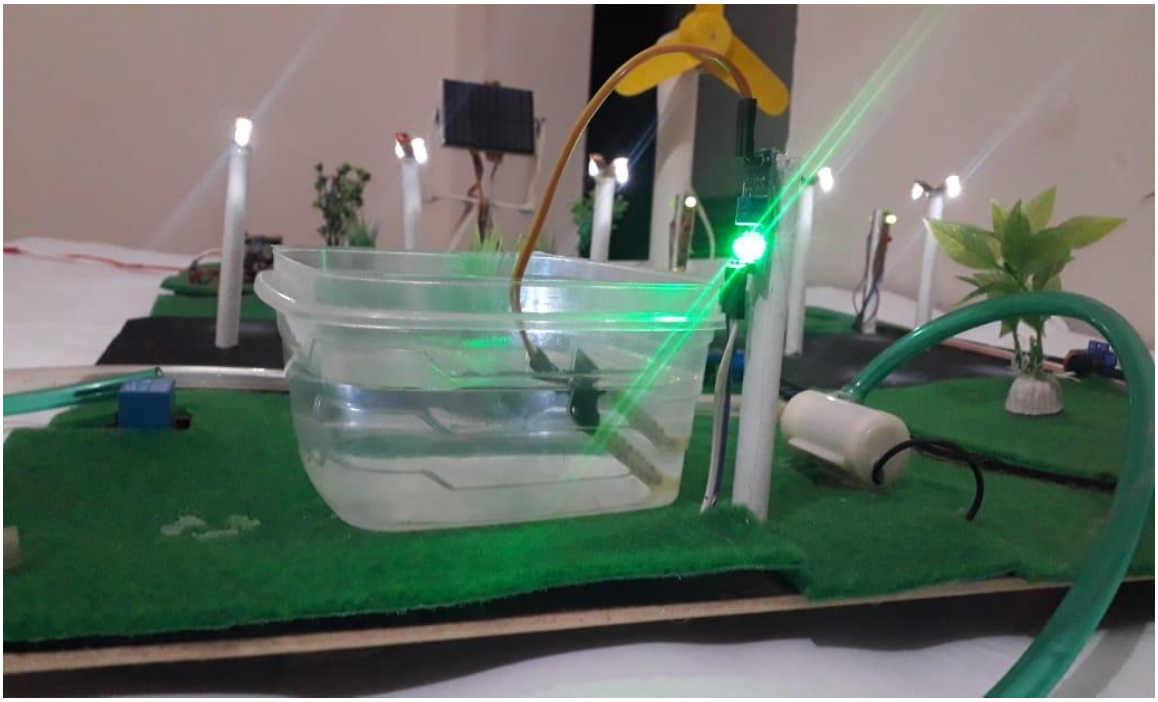


Figure 5.3: Soil Moisture sensor with water Pump.

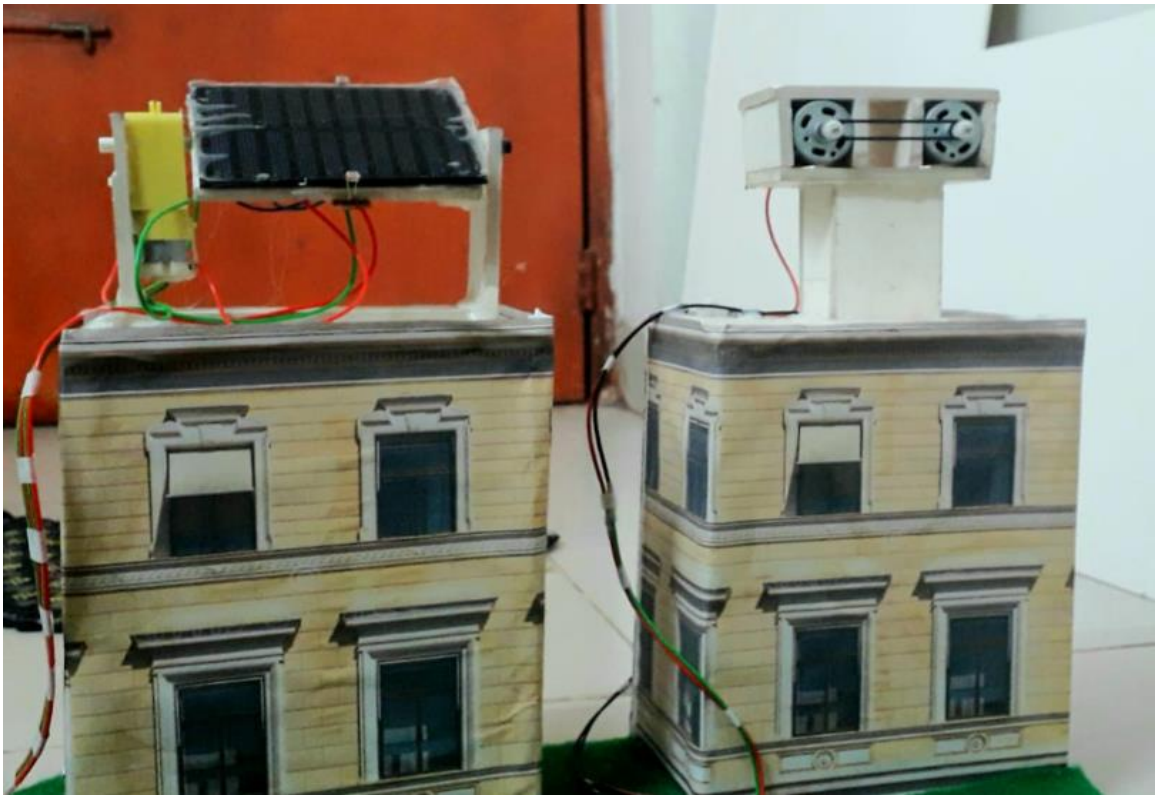


Figure 5.4: Solar and wind power generation system.



Figure 5.5: Street lighting system.

## 5.2 Calculation

### 5.2.1 Calculation of Solar Power Generation

The simple formula for calculating solar panel output is:

1. Average hours of sunlight x solar panel watts x 75% = daily watt-hours.

2. 5 hours x 290 watts x 0.75 = 1,087.5 daily watt-hours.

3. That will be 1.0875 kilowatt-hours per solar panel.

Production of Electricity from per Solar:

| S/L | Panel | Day | Month | Year |
|---|---|---|---|---|
| 01 | 1 pcs | 1.0875 kw | 32.625 kw | 391.5 kw |
| 02 | 10 pcs | 10.875 kw | 326.25 kw | 3915 kw |
| 03 | 100 pcs | 108.75 kw | 3262.5 kw | 39150 kw |

### 5.2.2 Calculation of Wind Power Generation

The formula is capacity factor = actual output/maximum possible output.

For a wind turbine, the maximum possible output would be the capacity x 8760 hr (there are 8760 hrs in a year).

Per hour power generation from single wind turbine = 790w

Production of Electricity from per Wind:

| S/L | Wind | Per Hour | Day | Month | Year |
|---|---|---|---|---|---|
| 01 | 1 pcs | 0.79 w | 18.96 kw | 568.8 kw | 6825.6 kw |
| 02 | 10 pcs | 7.9 kw | 189.6 kw | 5688 kw | 68256 kw |
| 03 | 100 pcs | 79 kw | 1896 kw | 56880 kw | 682560 kw |

### 5.2.3 Calculation of Power Consumption:

| S/L | Place | Per Hour | Day | Month | Year |
|---|---|---|---|---|---|
| 01 | Hospital | 0.317 Kw | 7.608 kw | 228.24 kw | 2738.88 kw |
| 02 | School | 0.87 kw | 20.88 kw | 626.4 kw | 7516.8 kw |
| 03 | Residential | 0.287 kw | 6.888 kw | 206.64 kw | 2479.68 kw |
| 04 | Controlling unit | 0.57 kw | 13.68 kw | 410.4 kw | 4924.8 kw |

## 5.3 Power Demand for Project Operation

| S/L | Component | Watt | Quantity | Total Watt |
|---|---|---|---|---|
| 01 | Arduino Mega | 9 w | 1 | 9 w |
| 02 | LDR | 0.45 w | 3 | 1.35 w |
| 03 | Servo Motor | 3.5 w | 2 | 7 w |
| 04 | BO Motor | 3.5 w | 1 | 3.5 w |
| 05 | Relay | 1.5 w | 2 | 3 w |
| 06 | LED | 0.65 w | 18 | 11.7 w |
| 07 | LCD | 6 w | 1 | 6 w |
| 08 | Soil Sensor | 2.5 w | 1 | 2.5 w |
| 09 | Water Pump | 3 w | 1 | 3 w |
| 10 | IR Sensor | 3 w | 2 | 3 w |
| 11 | Buzzer | 0.52 w | 2 | 1.4 w |
| **Total =** | | | | **50.1w** |

**Total required power demand in our Project = 50.1 watt**

# Chapter 6

# Conclusion

## 6.1 Advantages

In this Eco system there have many advantages:

- Can control the street light automatically.
- Can generate power from wind using a fan.
- Can generate power from solar panel using sun ray.
- Can operate irrigation system automatically.
- Can measure the value of generated and stored power.
- More effective, data-driven decision-making.
- Enhanced citizen and government engagement.
- Safer communities.
- Reduced environmental footprint.
- Improved transportation.
- Increased digital equity.
- New economic development opportunities.
- Efficient public utilities.

## 6.2 Disadvantages

In this Eco system there have many advantages:

- Lack of public awareness and social responsibility.
- Building and maintaining the infrastructure is costly and challenging.
- Demands 24X7 connectivity and power supply.
- Security issues in terms of public data.
- May lead a way towards social discrimination.

## 5.3 Limitations

In this Eco system there have some limitations:

- Arduino based smart city is not effective for a long days.
- Wind power system produce a low voltage in this system.
- Here used a mini solar panel it also provide small power.
- Irrigation system is designed with only one soil sensor not broadly.
- Rail crossing system is difficult for broadly used.

## 6.4 Conclusion

A solar panel tracking system was designed and implemented. The aim of the solar panel tracking system is to track the position of the sun for better efficiency of the solar panel has shown in the experimental results. This work can be executed on an industrial scale which be beneficial to developing countries like Nigeria and Sub-Sahara Africa countries. Our recommendation for future works is to consider the use of more sensitive and efficient sensors which consume less power and which are also cost effective. This would increase the efficiency while reducing cost.

We presented a new technique for railway signaling system for developing countries. The hardware used in this system consists of solar cell panel, charger control unit, and battery storage designed for selfenergy management and low power consumption. These features are suitable for installation in real environment. As a prototype of an automatic railway crossing system, the developed system is very useful for further development and application in railway crossing system management in Thailand.

# References


[1] Caetano, F., Pitarma, R., & Reis, P. (2015). Advanced System for Garden Irrigation Management.In New Contributions in Information Systems and Technologies (pp. 565–574). https://doi.org/10.1007/978-3-319-16486- 1_55

[2] Chavan, C. H., &Karande, P. V. (2014). Wireless Monitoring of Soil Moisture, Temperature & Humidity Using Zigbee in Agriculture. International Journal of Engineering Trends and Technology, 11(10), 493–497.

[3] Dobbs, N. A., Migliaccio, K. W., Li, Y., Dukes, M. D., & Morgan, K. T. (2014). Evaluating irrigation applied and nitrogen leached using different smart irrigation technologies on bahiagrass (Paspalumnotatum). Irrigation Science, 32, 193–203.

[4] KomiteNasionalKeselamatanTransportasi. (2017). InvestigasiKeselamatanTransportasi 2017. Jakarta, Indonesia.

[5] Wijaya, S.P., Christiyono, Y. and Sukiswo. (2010). Alatpelacaklokasiberbasis GPS via komunikasiseluler.UniversitasDiponegoro, Semarang.

[6] Ramadi, R. (2011). PembuatanAplikasi History Perjalanan GPS Tracker Berbasis Web PadaHandphoneMenggunakan J2ME.Universitas Islam NegeriSyarifHidayattulah, Jakarta, Indonesia.

[7] Pradata, R. (2013). SistemKeamanandanPemantauanLokasi Mobil denganFasilitas SMS.UniversitasBrawijaya, Malang, Indonesia.

[8] Ramani, R. (2013). “Vehicle tracking and locking system based on GSM and GPS”. Int. J. of Intelligent Systems and Applications (IJISA) 5(9):86-102.

[9] Nurhatono, A. (2015). PerancanganSistemKeamananUntukMengetahuiPosisiKendaraan yang HilangBerbasis GPS danDitampilkan di Smartphone.UniversitasNegeri Yogyakarta, Indonesia.

[10] Rizkidiniah, F., Yamin, M. and Muchlis, N.F. (2016). “Perancangandanimplementasi prototype sistem GPS (Global Positioning System) dan SMS gateway padapencariankendaraanbermotorberbasisarduinouno”. J. of Semantik 2(2):87-92, UniversitasHalu Oleo, Indonesia.

[11] Sahoo, B.P.S. and Rath, S. (2012). “Integrating GPS, GSM and cellular phone for location tracking and monitoring”.Proc. Int. Conf. on Geospatial Techno.and Applications, Geomatrix’12, IIT Bombay, Mumbai, India, Feb. 26-29.

[12] Sakib, S. and Bin Abdullah, M.S. (2016). “GPS-GSM based inland vessel tracking system for automatic emergency detection and position notification”. Proc. 10th Int. Conf. on Intelligent Systems and Control (ISCO), Coimbatore, pp. 1-4.

# Appendix

## Programming Code:

```
#include <Servo.h>

Servo myservo;

Servo tap_servo1;
int sensor_pin1 = 24;
int tap_servo_pin1 =25;
int led_red1 = 30;
int led_green1 = 31;

Servo tap_servo2;
int sensor_pin2 = 26;
int tap_servo_pin2 =27;
int led_red2 = 32;
int led_green2 = 33;
int val1;
int val2;

#define ldr1 A0
#define ldr2 A1

Int pos = 90;
int tolerance = 20;
```

```
int water; //random variable

void setup(){
myservo.attach(28);
pinMode(ldr1, INPUT);
pinMode(ldr2, INPUT);
pinMode (led_red1, OUTPUT);
pinMode (led_green1, OUTPUT);
pinMode (led_red2, OUTPUT);
pinMode (led_green2, OUTPUT);

pinMode(sensor_pin1,INPUT);
pinMode(sensor_pin2,INPUT);

pinMode(50, OUTPUT); //output pin for relay board, this will sent signal to the relay
pinMode(51, INPUT); //input pin coming from soil sensor

digitalWrite(30, LOW);
digitalWrite(31, HIGH);
digitalWrite(32, LOW);
digitalWrite(33, HIGH);



tap_servo1.attach(tap_servo_pin1);
tap_servo2.attach(tap_servo_pin2);
```

```
myservo.write(pos);


delay(1000);
}


void loop(){


   val1 = digitalRead(sensor_pin1);
   val2 = digitalRead(sensor_pin2);


int val3 = analogRead(ldr1);
int val4 = analogRead(ldr2);


water = digitalRead(51); // reading the coming signal from the soil sensor


if(water == HIGH) // if water level is full then cut the relay
{
digitalWrite(50, HIGH); // low is to cut the relay
}
else
{
digitalWrite(50, LOW); //high to continue proving signal and water supply
}
delay(400);
```

```
if((abs(val3 - val4) <= tolerance) || (abs(val3 - val4) <= tolerance)) {


}else {

if(val3 > val4) // if ldr1 senses more light than ldr2

{

pos = pos+1; // decrement the 90 degree poistion of the horizontal servo motor - this will move the panel position Eastward

}

if(val3 < val4) // if ldr2 senses more light than ldr1

{

pos = pos-1; // increment the 90 degree position of the horizontal motor - this will move the panel position Westward

 }

}


if(pos> 180) {pos = 180;} // reset the horizontal postion of the motor to 180 if it tries to move past this point

if(pos< 0) {pos = 0;} // reset the horizontal position of the motor to 0 if it tries to move past this point

myservo.write(pos);

delay(50);


if (val1==0)

  {

    tap_servo1.write(0);

digitalWrite(30, LOW);

digitalWrite(31, HIGH);
```

```
  }
if (val1==1)
  {
    tap_servo1.write(180);
digitalWrite(30, HIGH);
digitalWrite(31, LOW);
delay (1000);
    }

if (val2==0)
  {
    tap_servo2.write(0);
digitalWrite(32, LOW);
digitalWrite(33, HIGH);
  }
if (val2==1)
  {
    tap_servo2.write(180);
digitalWrite(32, HIGH);
digitalWrite(33, LOW);
delay (1000);
    }
}
```