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ABSTRACT

This project describes about the "**TRAFFIC LIGHT CONTROLLER USING ARDUINO**".It will control the traffic while vehicle crossing the highway.it may cause some accidents nowadays sensor will detect the vehicle.If the vehicle will reach the crossing line it will change the traffic light on the highway as well as farm way.In order to overcome the vital issues like accidents on highways, a new method using PIR Sensor technology is proposed. It can serve as a best solution to automatically operated traffic signal.The object detection sensor deployed at the traffic signal path senses the vehicle coming from Farmway.There is a sensor in the farm way side to detect if there is any vehicle on the farm way .If vehicles are detected

on the farm way, traffic light on the high way turns to YELLOW, then RED so that the vehicles from the farm way can cross the high way.Otherwise, the traffic light on the high way is always GREEN and traffic light on the farm way is always RED.The time period is 3 seconds for the YELLOW light and 10 seconds for the RED light.

Chapter 1:Introduction

The use of personal vehicles is very common now a days and a result, the number of vehicles on the roads are exponentially increasing. Roads without any supervision or guidance can lead in to traffic congestions and accidents.

Traffic Lights or Traffic Signals are signalling devices that are used to control the flow of traffic. Generally, they are positioned at junctions, intersections, 'X' roads, pedestrian crossings etc. and alternate the priority of who has to wait and who has to go.

The traffic lights will provide instructions to the users (drivers and pedestrians) by displaying lights of standard color. The three colors used in traffic lights are Red, Yellow and Green.

The system must be used to control the traffic lights for smooth and safe movement of traffic. These control systems consist of electro mechanical controllers with clockwork mechanisms or modern solid state computerised systems with easy setup and maintenance.

Traffic lights, also known as traffic signals, traffic lamps, signal lights, robots are signaling devices positioned at or near road intersections, pedestrian crossings and other locations to control competing flows of traffic. Traffic lights were first installed in 1868 in London, United Kingdom; now used in almost every city of the world. Traffic lights alternate the right of way accorded to road users by displaying lights of a standard color (red, yellow/amber, and green) following a universal color code (and a precise sequence to enable comprehension

Chapter 2: Equipments

2.1: SOFTWARE REQUIREMENTS:

Introduction to Arduino IDE

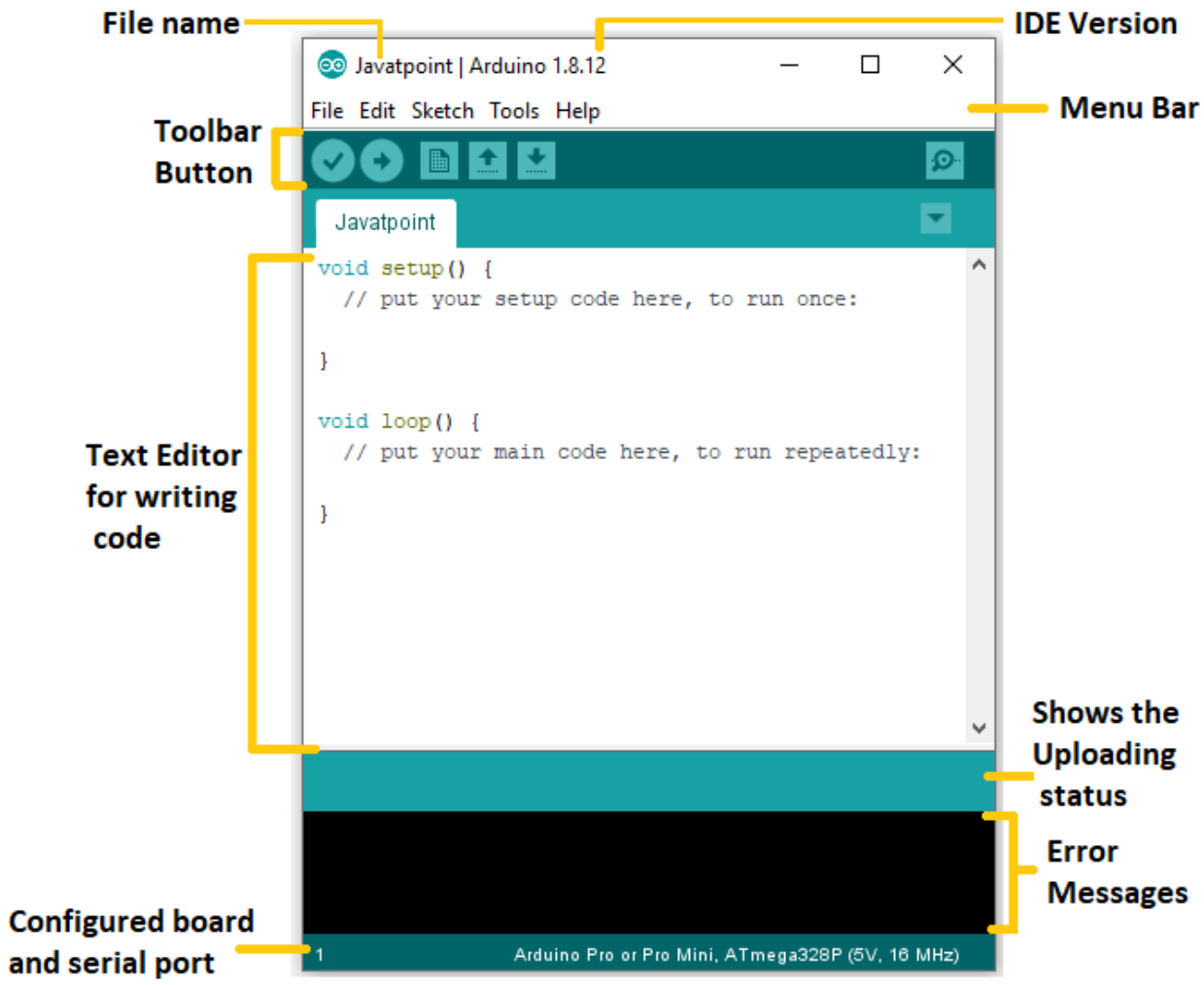
- **Arduino IDE** is an open-source software, designed by Arduino.cc and mainly used for writing, compiling & uploading code to almost all Arduino Modules.
- It is an official Arduino software, making code compilation too easy that even a common person with no prior technical knowledge can get their feet wet with the learning process.
- It is available for all operating systems i.e. MAC, Windows, Linux and runs on the Java Platform that comes with inbuilt functions and commands that play a vital role in debugging, editing and compiling the code.

- A range of Arduino modules available including Arduino Uno, Arduino Mega, Arduino Leonardo, Arduino Micro and many more.
- Each of them contains a microcontroller on the board that is actually programmed and accepts the information in the form of code.

- The main code, also known as a sketch, created on the IDE platform will ultimately generate a Hex File which is then transferred and uploaded in the controller on the board.
- The IDE environment mainly contains two basic parts: Editor and Compiler where former is used for writing the

required code and later is used for compiling and uploading the code into the given Arduino Module.

- This environment supports both C and C++ languages.



2.2: HARDWARE REQUIREMENTS

Arduino UNO

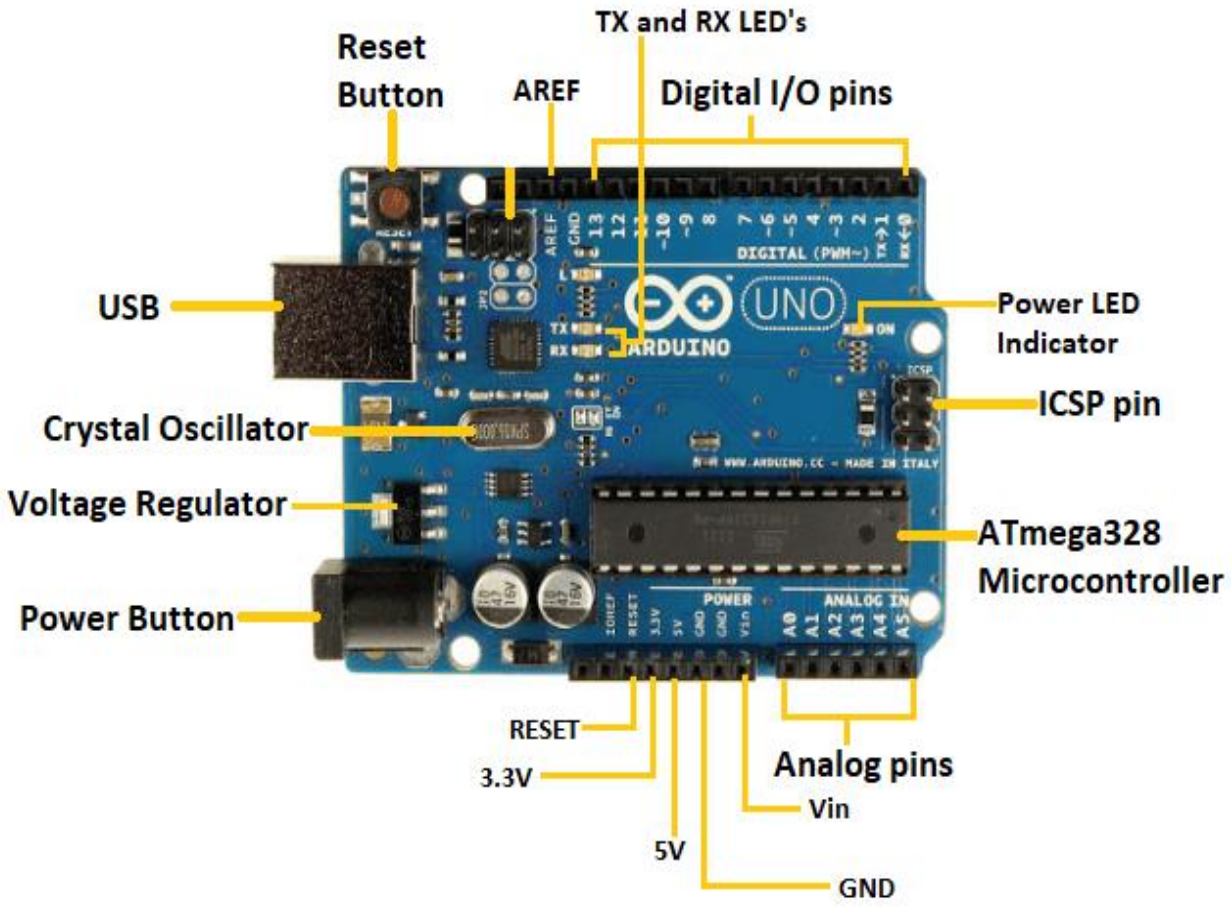
The Arduino UNO is a standard board of Arduino. Here UNO means 'one' in Italian. It was named as UNO to label the first release of Arduino Software. It was also the first USB board released by Arduino. It is considered as the powerful board used in various projects. Arduino.cc developed the Arduino UNO board.

Arduino UNO is based on an ATmega328P microcontroller. It is easy to use compared to other boards, such as the Arduino Mega board, etc. The board consists of digital and analog Input/Output pins (I/O), shields, and other circuits.

The Arduino UNO includes 6 analog pin inputs, 14 digital pins, a USB connector, a power jack, and an ICSP (In-Circuit Serial Programming) header. It is programmed based on IDE, which stands for Integrated Development Environment. It can run on both online and offline platforms.

The IDE is common to all available boards of Arduino.

The Arduino board is shown below:



Let's discuss each component in detail.

- **ATmega328 Microcontroller-** It is a single chip Microcontroller of the ATmel family. The processor code inside it is of 8-bit. It combines **Memory (SRAM, EEPROM, and Flash), Analog to Digital Converter, SPI serial ports, I/O lines, registers, timer, external and internal interrupts, and oscillator.**
- **ICSP pin** - The In-Circuit Serial Programming pin allows the user to program using the firmware of the Arduino board.

- **Power LED Indicator**- The ON status of LED shows the power is activated. When the power is OFF, the LED will not light up.
- **Digital I/O pins**- The digital pins have the value HIGH or LOW. The pins numbered from D0 to D13 are digital pins.
- **TX and RX LED's**- The successful flow of data is represented by the lighting of these LED's.
- **AREF-** The Analog Reference (AREF) pin is used to feed a reference voltage to the Arduino UNO board from the external power supply.
- **Reset button**- It is used to add a Reset button to the connection.
- **USB**- It allows the board to connect to the computer. It is essential for the programming of the Arduino UNO board.
- **Crystal Oscillator**- The Crystal oscillator has a frequency of 16MHz, which makes the Arduino UNO a powerful board.
- **Voltage Regulator**- The voltage regulator converts the input voltage to 5V.
- **GND**- Ground pins. The ground pin acts as a pin with zero voltage.
- **Vin**- It is the input voltage.
- **Analog Pins**- The pins numbered from A0 to A5 are analog pins. The function of Analog pins is to read the analog sensor used in the connection. It can also act as GPIO (General Purpose Input Output) pins.

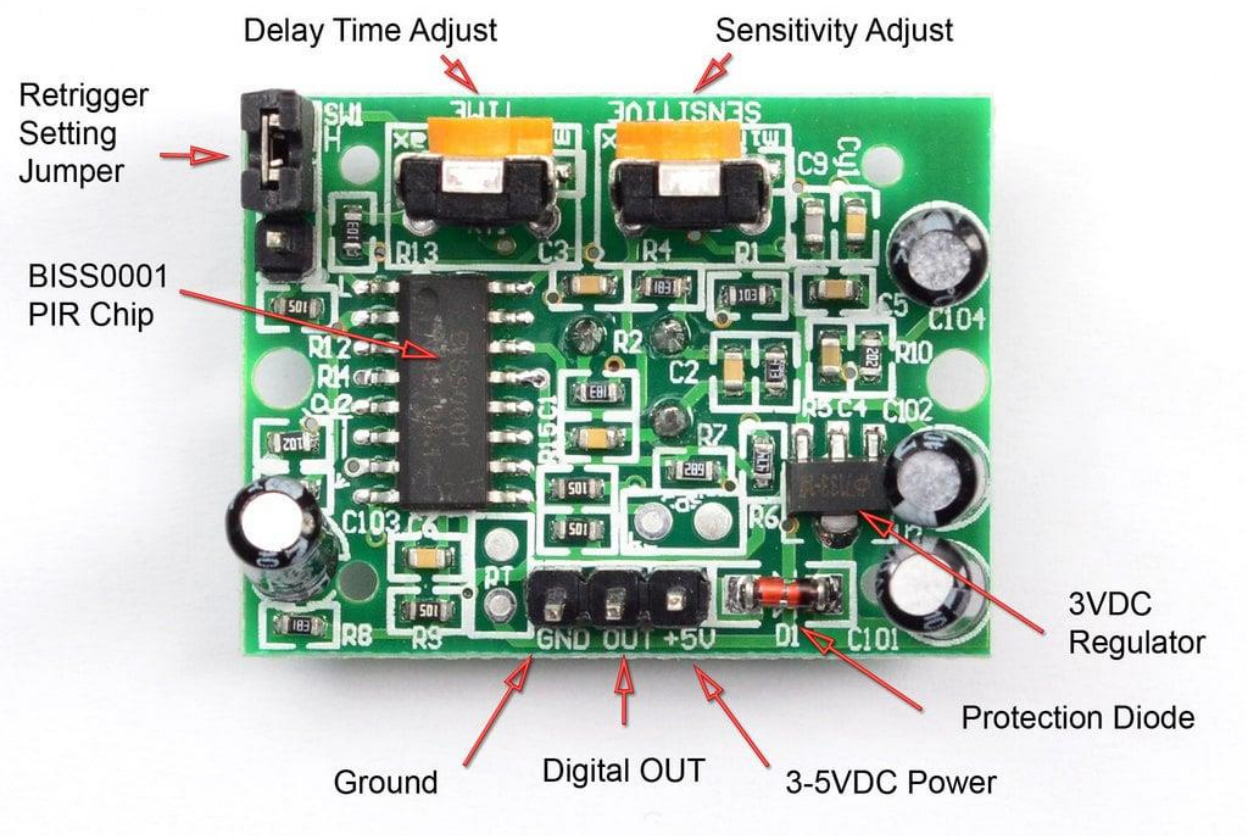
PIR Sensor

PIR sensors allow you to sense motion, almost always used to detect whether a human has moved in or out of the sensors range. They are small, inexpensive, low-power, easy to use and don't wear out. For that reason they are commonly found in appliances and gadgets used in homes or businesses. They are often referred to as PIR, "Passive Infrared", "Pyroelectric", or "IR motion" sensors.

PIRs are basically made of a pyroelectric sensor (which you can see below as the round metal can with a rectangular

crystal in the center), which can detect levels of infrared radiation. Everything emits some low level radiation, and the hotter something is, the more radiation is emitted. The sensor in a motion detector is actually split in two halves. The reason for that is that we are looking to detect motion (change) not average IR levels. The two halves are wired up so that they cancel each other out. If one half sees more or less IR radiation than the other, the output will swing high or low. Along with the pyroelectic sensor is a bunch of supporting circuitry, resistors and capacitors. It seems that most small hobbyist sensors use the BISS0001 ("Micro Power PIR Motion Detector IC"), undoubtedly a very inexpensive chip. This chip takes the output of the sensor and does some minor processing on it to emit a digital output pulse from the analog sensor.

Our new PIRs have more adjustable settings and have a header installed in the 3-pin ground/out/power pads

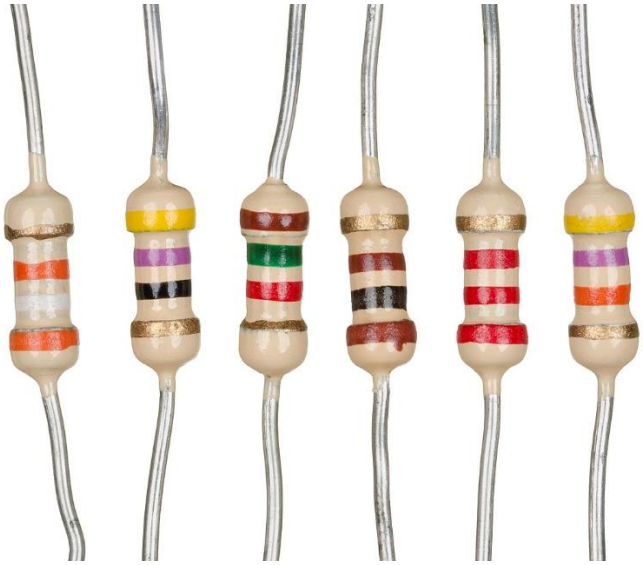

Delay Time Adjust
Sensitivity Adjust
Retrigger
Setting
Jumper
BISS0001
PIR Chip
3VDC
Regulator
Protection Diode
Ground
Digital OUT
3-5VDC Power
GND OUT +5V

Resistor:

Resistor is defined as

A passive electrical component with two terminals that are used for either limiting or regulating the flow of electric current in electrical circuits.

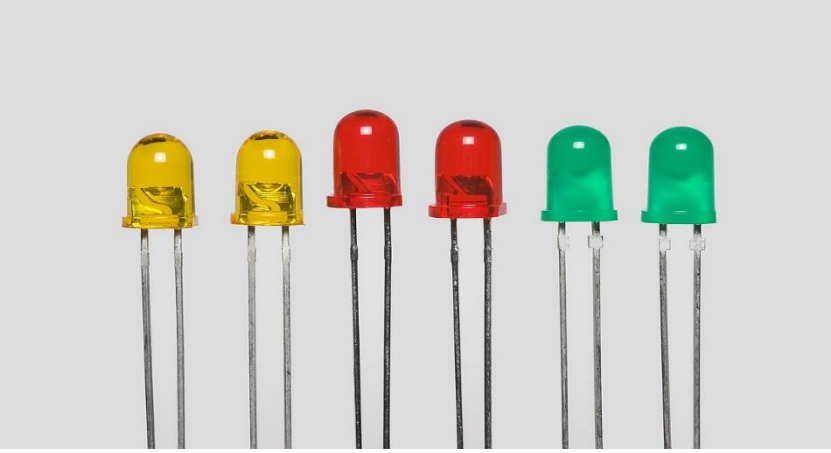
The main purpose of resistor is to reduce the current flow and to lower the voltage in any particular portion of the circuit. It is made of copper wires which are coiled around a ceramic rod and the outer part of the resistor is coated with an insulating paint.



LEDs:

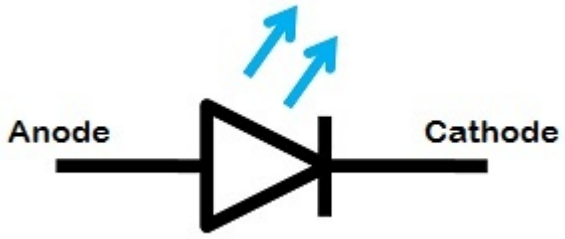
The Light-emitting diode is a two-lead semiconductor light source. In 1962, Nick Holonyak has come up with the idea of a light-emitting diode, and he was working for the general electric company. The LED is a special type of diode and they have similar electrical characteristics to a PN junction diode. Hence the LED allows the flow of current in the forward direction and blocks the current in the reverse direction. The LED occupies a small area which is less than **1 mm^2**. The applications of LEDs used to make various electrical and electronic projects. In this article, we will discuss the working principle of the LED and its applications.

The lighting emitting diode is a p-n junction diode. It is a specially doped diode and made up of a special type of semiconductors. When the light emits in the forward biased, then it is called a light-emitting diode.



LED Symbol

The LED symbol is similar to a diode symbol except for two small arrows that specify the emission of light, thus it is called LED (light-emitting diode). The LED includes two terminals namely anode (+) and the cathode (-). The LED symbol is shown below.



Connecting wires:

Connecting wires allows an electrical current to travel from one point on a circuit to another, because electricity needs a medium through which to move. In the case of computers, wires are embedded into circuit boards, carrying pulses of electricity that are interpreted as binary signals of zeros and ones.

Most wires in computers and electronic components are made of copper or aluminum. Copper is cheap and electrically conductive. Silver has higher conductivity but is far more expensive.

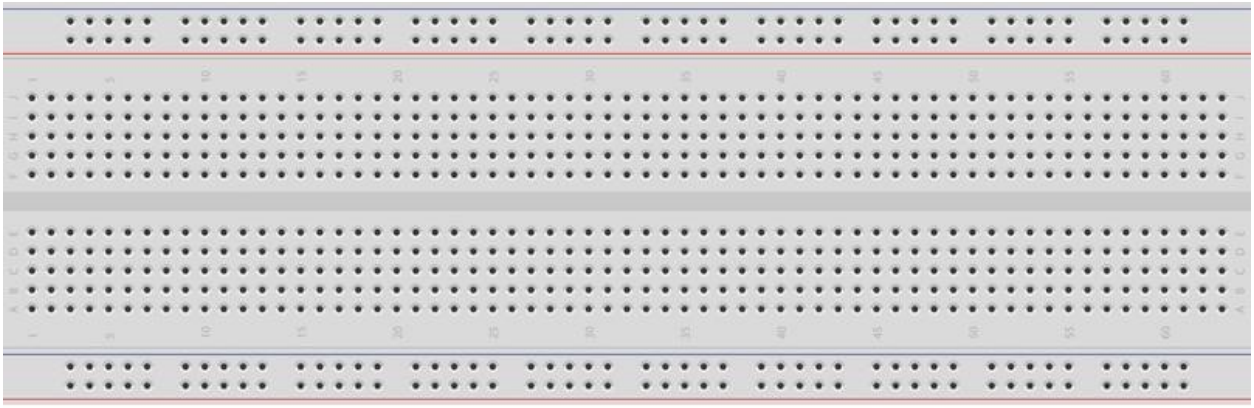
In a basic circuit, the wire comes from one terminal of a power source, such as a battery. It then connects to a switch that determines whether the circuit is open or closed. The wire then connects to the device that is drawing power, allowing it to draw electricity and perform its task. Finally, the wire connects the load back to the opposite terminal of the power source.

Before a current can travel through the wire, the circuit has to be closed; in other words, there cannot be any breaks in the path. Electricity cannot easily travel through air, and if it does there is a risk of stray current leaking into the surroundings and causing damage or failing to power the appliance.

Breadboard:

A Breadboard is simply a board for prototyping or building circuits on. It allows you to place components and connections on the board to make circuits without soldering. The holes in the breadboard take care of your connections by physically holding onto parts or wires where you put them and electrically connecting them inside the board. The ease of use and speed are great for learning and quick prototyping of simple circuits. More complex circuits and high frequency circuits are less suited to breadboarding. Breadboard circuits are also not ideal for long term use like circuits built on perfboard (protoboard) or PCB (printed circuit board), but they also don't have the soldering (protoboard), or design and manufacturing costs (PCBs).

As mentioned before, a breadboard is handy because you can set up circuits quickly and temporarily to test them and move on to a more permanent arrangement after investigating how it works on the breadboard. They are great for hobbyists and tinkerers to set up projects as a standalone device, or as a peripheral to an Arduino, Raspberry Pi, LaunchPad, BeagleBone, and many other development boards. They come in many sizes to fit projects large and small. Breadboards are also inexpensive, and the parts that work with them are also typically inexpensive too. If you want to make your project more permanent, moving from a design on a breadboard to protoboard or PCB will be easier than skipping to those harder to manipulate boards.



Advantages of Breadboard

The advantages of using breadboard are listed below:

- **Temporary prototype**
  We can build a temporary prototype for the projects with the help of a breadboard.
- **Reusable**
  Today, Solderless boards are mostly used in various applications. It does not require any soldering to fix the components. Hence, it can be reused.
- **Lightweight**
  The breadboard is made of white plastic, which is light in weight.
- **Easy experimentation**
  We can quickly insert the leads of the components into the tiny holes of the breadboard. The circuit can be created using various components and circuit design.
- **Inexpensive**
  The breadboards are easily available. It also cost less.

- **Easy to use**
  It does not involve any complex parts. We can easily insert the required number of components.
- **No drilling required**
  The hoes are already embedded in the board. Hence, we do not require any drilling to insert the electronic components.
- **Quick modifying capability**
  We can easily switch or remove the components from the board.
- **Available in various sizes**
  The breadboards are available in various sizes. We can select the desired size as per the number of components.
- **Easy to adjust.**
  The breadboard is easy to adjust in the project or connection setup.

Chapter 3: Circuit Design

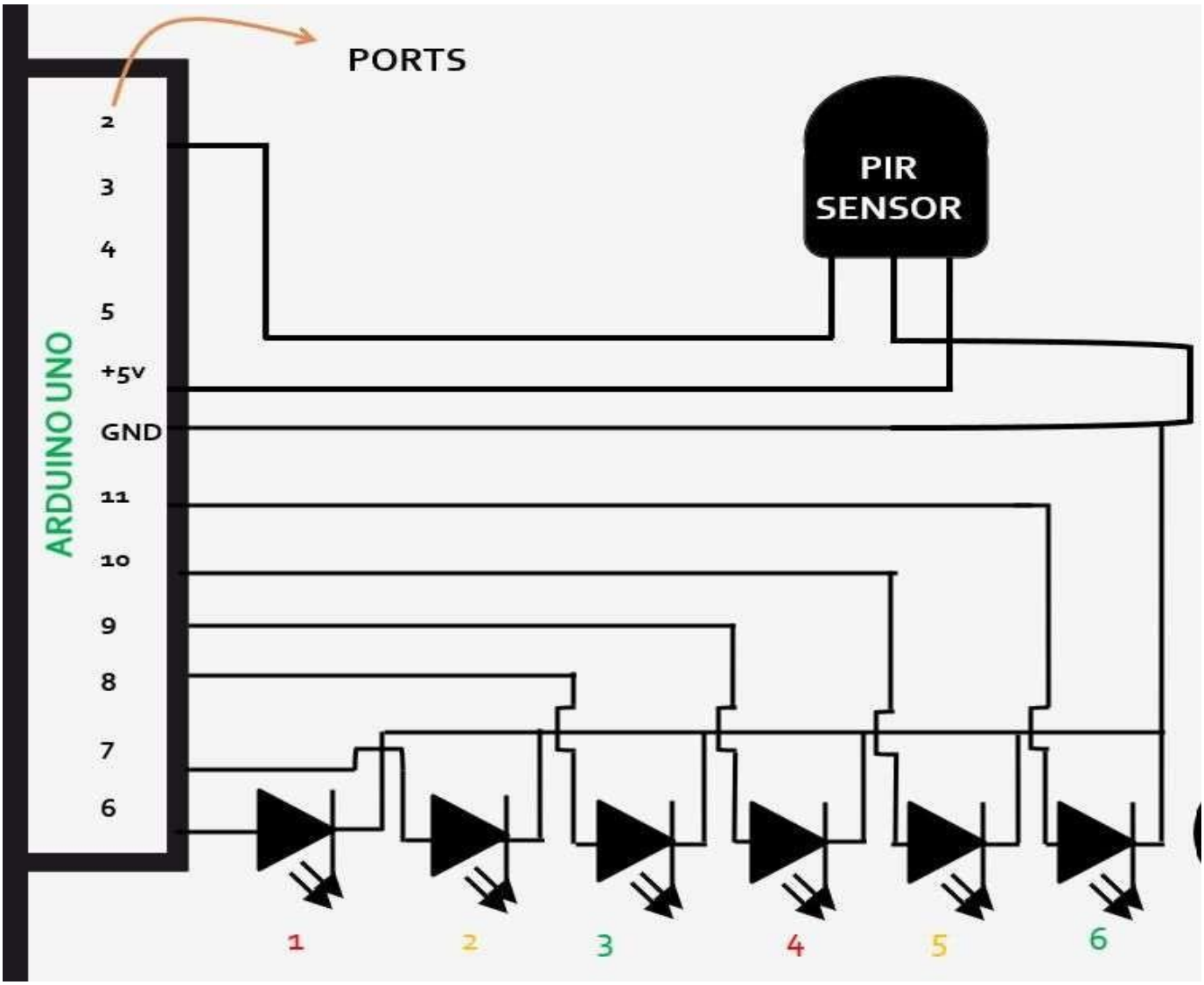
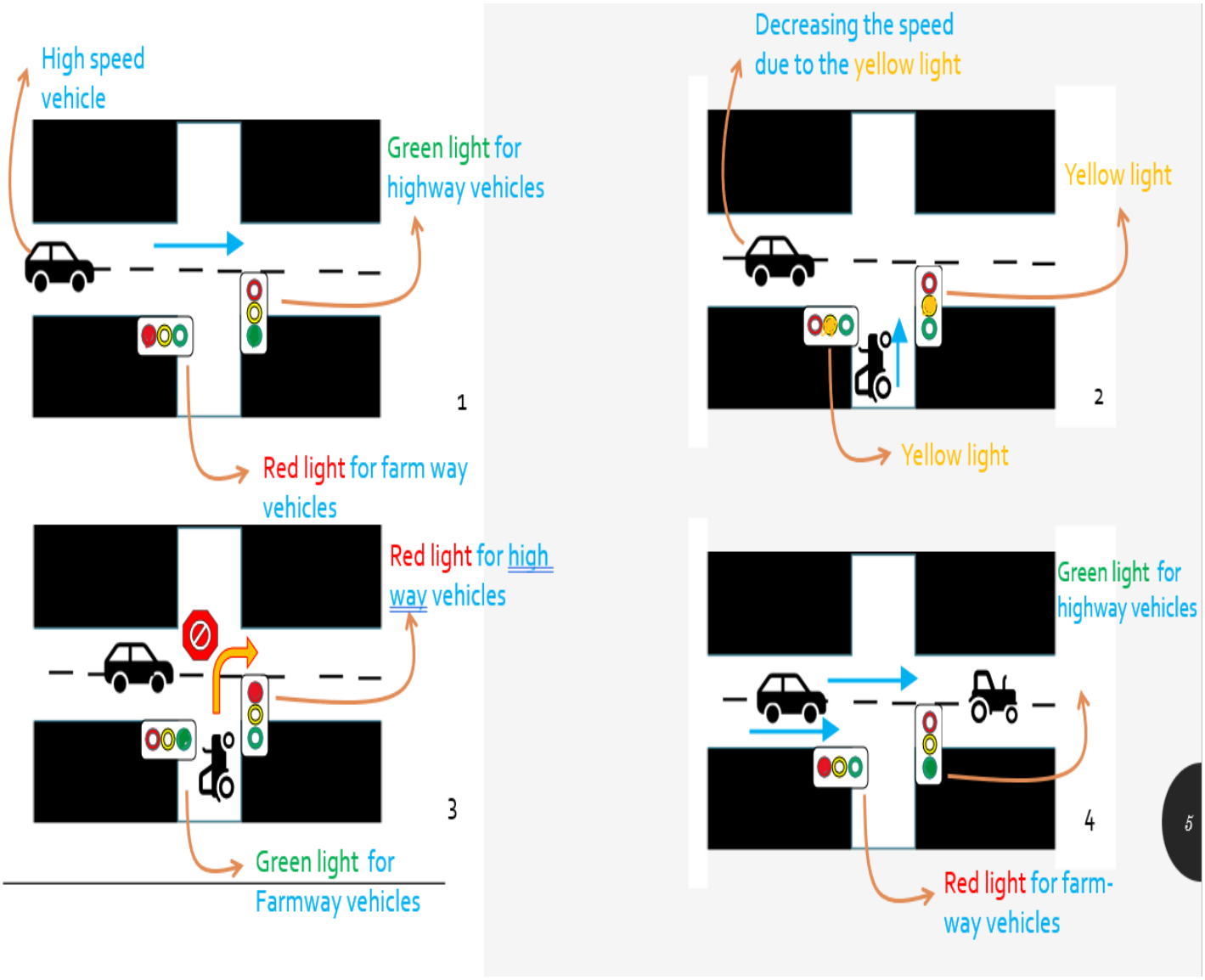
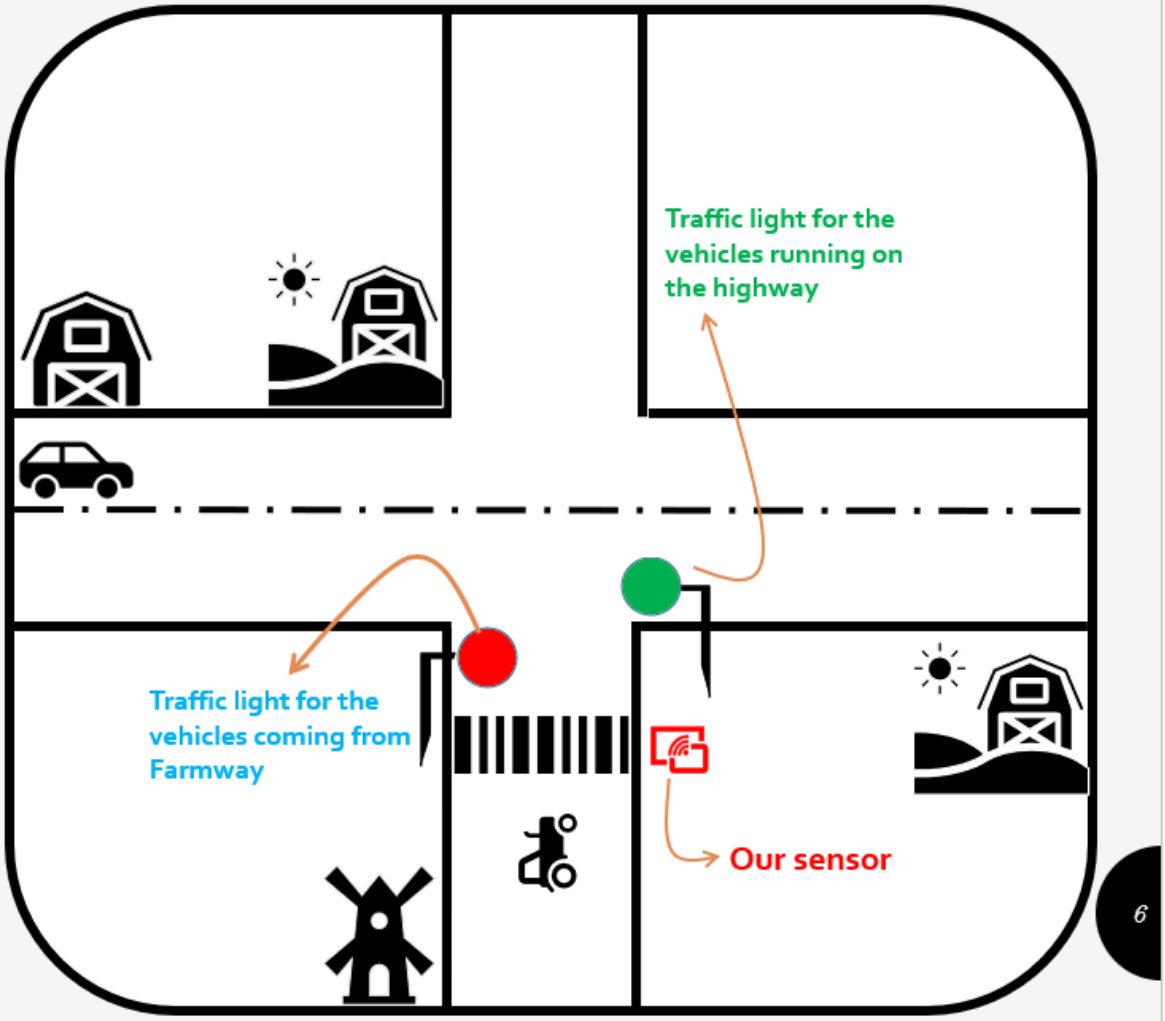


Figure: circuit diagram

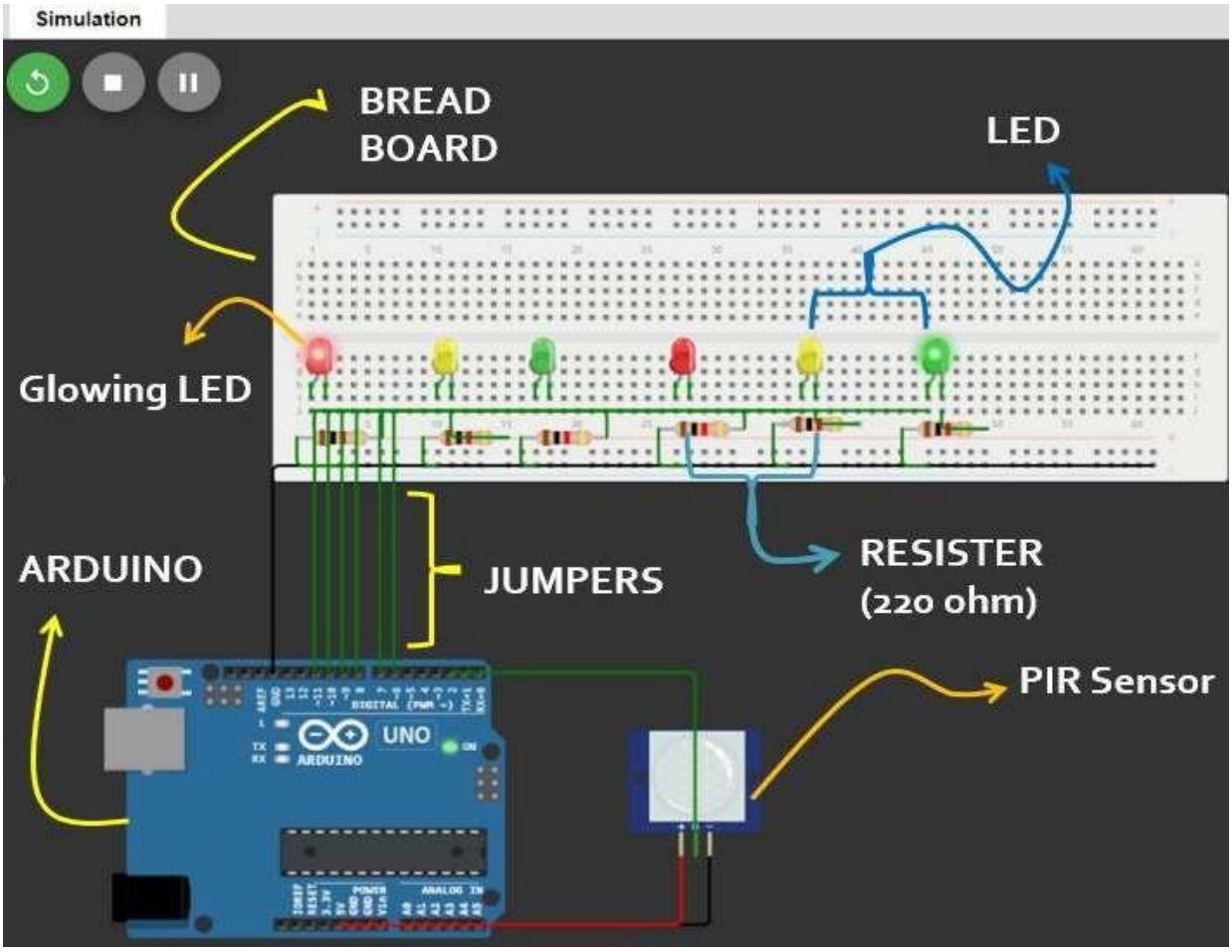
Chapter 4:Working Model




Traffic light for the vehicles running on the highway
Traffic light for the vehicles coming from Farmway
Our sensor
6

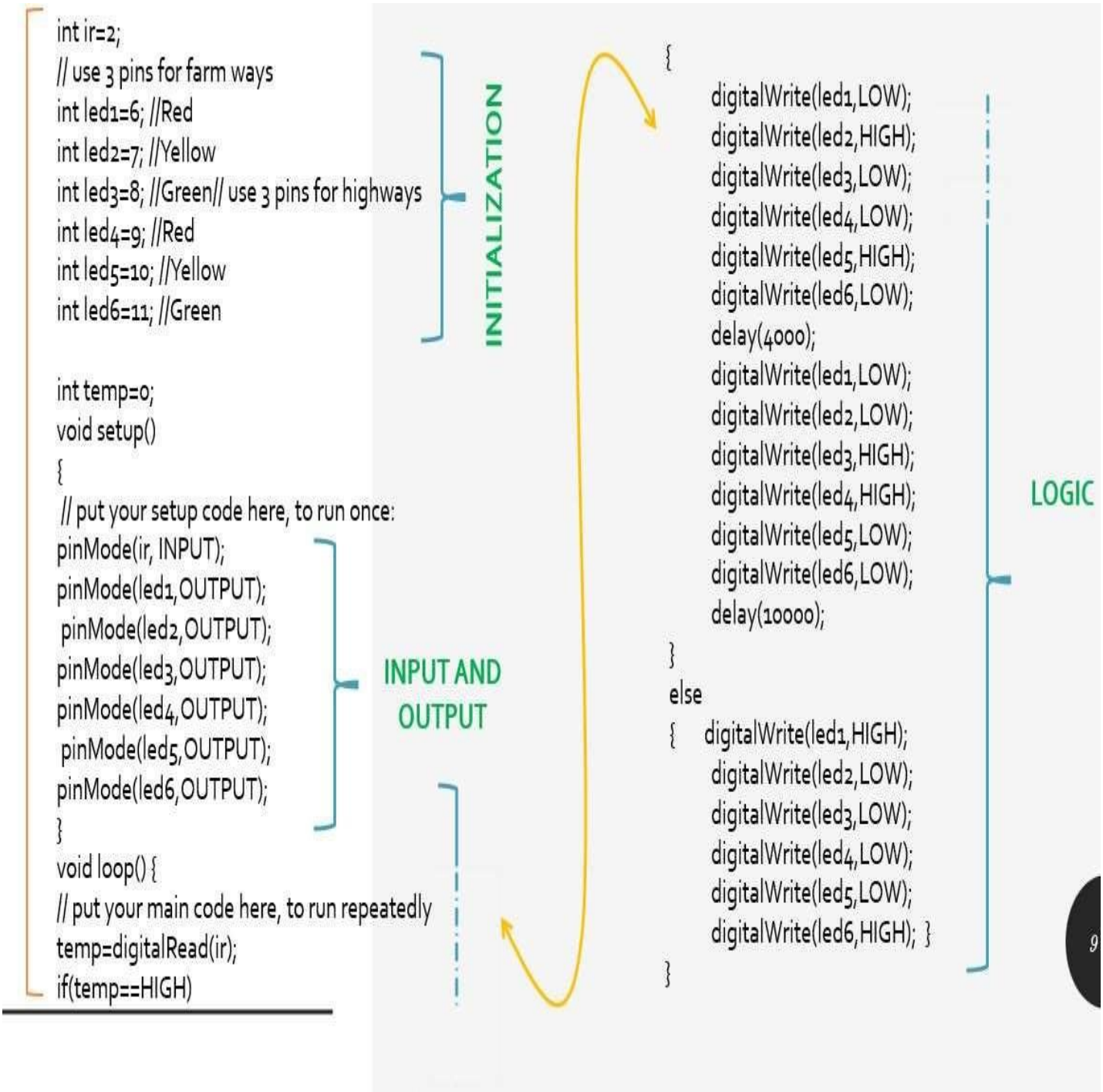
CHAPTER 5: HARDWARE DESCRIPTION

There is a sensor in the farm way side to detect if there is any vehicle on the farm way. If vehicles are detected on the farm way, traffic light on the high way turns to YELLOW, then RED so that the vehicles from the farm way can cross the high way. Otherwise, the traffic light on the high way is always GREEN and traffic lighton the farm way is always RED. The time period is 3 seconds for the YELLOW light and 10 seconds for the RED light.



[Online Arduino Simulation]

Chapter 6: Code



Chapter 7: Future Scope

If a vehicle (Tractor) coming from a side of a Farmway and want to go to the other side of the highway then the connection will be more complex.

On that case we need to connect the same sensor system to another side of the highway and also need to add more equipment and need to upgrade the code as per requirements. Then it will be a 4-way connection.

On the other hand, we also need to take more precautions than before and requires a good villager's co-operation.

KEY POINT: Enhancing the traffic light system with implementingthe green corridor.

Conclusion

The traffic light control system has been designed, constructed and tested to ensure validation of its function and operations. In this research, we have succeededin controlling the traffic in the junction of highway and Farmway using Arduino and PIR sensor. The system is effective and the cost of production is very low.

Future work is recommended in order to produce the device on a large scale anddeploy to all roads in order to reduce traffic congestion in places like national highways where accidents has become a big issue.

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