✍ ACKNOWLEDGEMENT

"If each of my words were a drop of water, you would see through them and glimpse what I feel: gratitude, acknowledgement"- Octavio Paz.

We are grateful to have the opportunity to express gratitude to all those concerned with our project titled ***"DC FAN CONTROL USING A SMARTPHONE"*** *.*

We feel absolutely blessed to express my deep gratitude to our supervisor, Prof. ***Sri Debabrata Sarkar(HOD,DEPT. OF ETCE,CENTRAL CALCUTTA POLYTECHNIC)****, whose lectures and guidance helped endlessly in preparation of this project and his constant care, suggestion and support remained elegant to every point of the work.*

We also would like to pay our sincere thanks to Prof. ***Shriman Kalyan Kumar Mallick****, whose endless patience and highly valuable advices and helpful actions constantly kept eyes on our work and contributed in constant progress.*

It's also impossible to forget all those people who directly or indirectly contributed throughout the journey, their guidance and endless support always helped us to avoid any pitfalls across the pathway.

And finally we are paying an endless sense of gratitude to all of my friends and team members who have always held my hand and companied me in preparing this project.

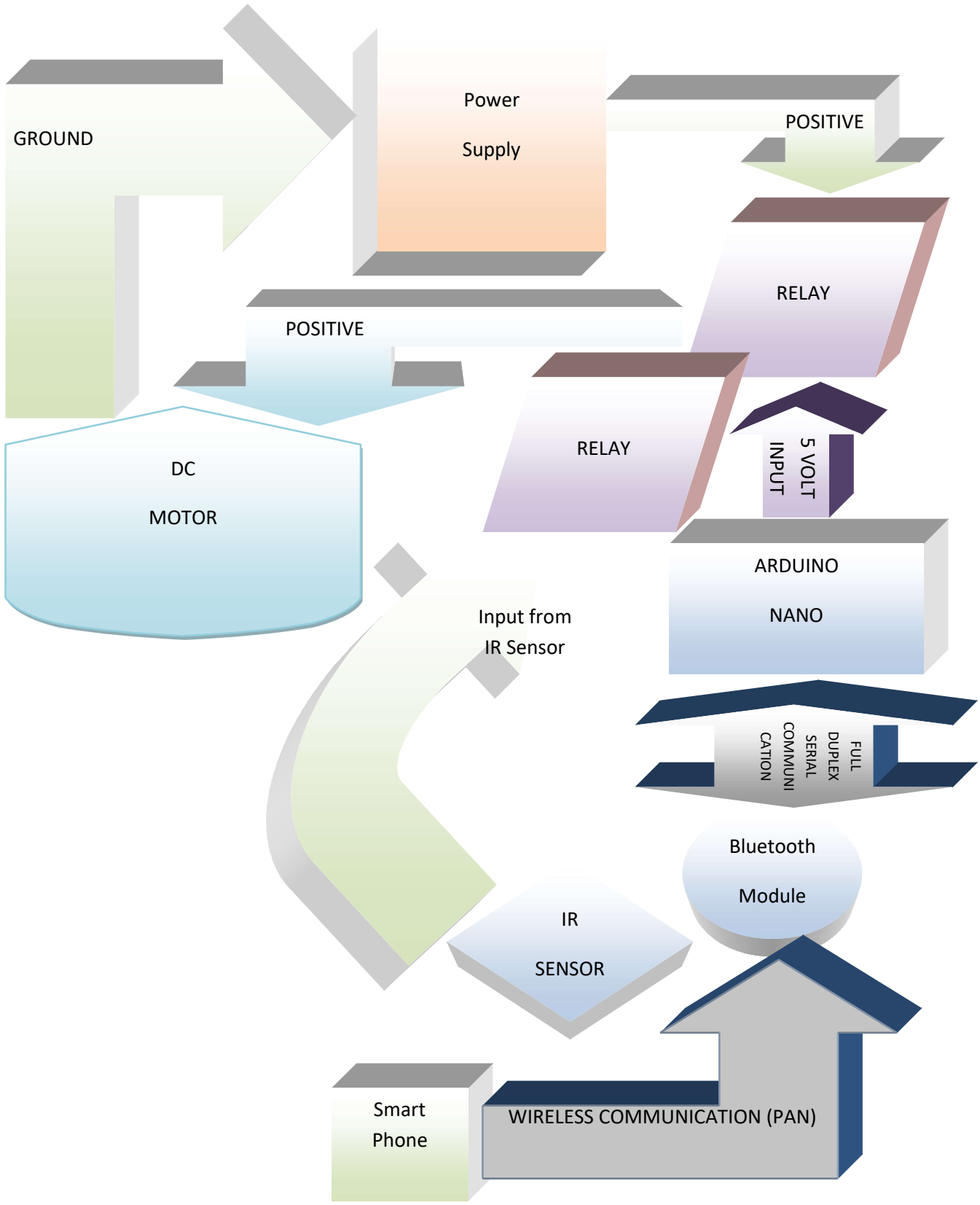
With Regards,

✶✶✶INTRODUCTION✶✶✶

Today “Internet of Things” or popularly called IOT is just a well designed fabrication of ideas designated by the implementation of some delicate interconnections of different real time objects with electronics and information technology embedded into them. Designing and fabricating full fledged IOT system requires excellent collaboration of Information Technology, Embedded Systems, Cloud Computing and of course some hands on approach to Analogue Electronics.

While designing this project, it has been our prime goal to implement all the above prospects though our particular and hence landed on the idea to manipulate a dc motor driven fan with the help of a Smartphone. Now the smart will participate in the PAN(Personal Area Network) creation through a BLUETOOTH PROTOCOL that gets established with the help of an app called Bluetooth that has been developed by us with “MIT APP INVENTER” website employing the concepts from Information Technology and has been made available forever through cloud storage in a GOOGLE DRIVE which is accessible through the QR code generated from its auto generated link to whoever comes to work with our system prototype. Now to use the BT(Bluetooth) signal is transmitted to a Bluetooth Module called HC-05 which can work as a Master for Serial communication with the “ARDUINO UNO” microcontroller board with its heart-ATmega328P microcontroller. The Arduino Board provides the output signal of 5 volts fed to a relay mounted over a Vero Board and closes the circuit from the Power Source to the input of the FAN turning the FAN On and here the game is handed over from Embedded Technology to Analogue Electronic Systems. As the Bluetooth Protocol works within 100 meters as BLE (BLUETOOOTH LOW ENERGY), the user can work with our prototype within the given range.

Also we provide the user with the opportunity to manipulate the same in case a smart phone is unavailable and still the user wants to work with our system-just by getting near the IR Sensor within its specified renage.IR Sensor has one LED that emits INFRARED LIGHT and a phototransistor that can act as an optical radiation detector being able to detect the Infrared Light reflected back from the object at its proximity.



BLOCK DIAGRAM OF THE INTEGRATED SYSTEM

✶✶✶BLOCK DESCRIPTION✶✶✶

- **Power Supply:** It provides DC power supply to the board.

- **Relay:** A dc 05 Volt Relay acting as a switch that turns on making the circuit closed one on feeding a 5 volt input from external source(here Arduino Nano) and opens the circuit when turns off upon removal of the input voltage.

- **Smart Phone:** Any Andriod smart phone device with an active internet connection supporting Bluetooth configuration and installation of apps from external sources.

- **Bluetooth Module:**HC-05 Bluetooth module makes a full duplex communication as it provides serial communication through the Tx and Rx pins for Transmission and Reception of the signal respectively.

- **Arduino Nano:**It is a microcontroller board driven by the ATmega 328P microcontroller having 14 digital i/o (6 can be used as PWM outputs) and 6 analog input pins.

- **DC motor:** It is that motor driven by the DC power supply.

- **IR sensor:**Infrared Sensor that is used in the input of the Arduino digital pins to sense any object nearby and output 5v to activate the fan by closing the circuit whenever its condition of proximity is fulfilled within the adjusted range of distance.

IR Sensor

IR sensor is an electronic device, that emits the light in order to sense some object of the surroundings. An **IR sensor** can measure the heat of an object as well as detects the motion. Usually, in the **infrared spectrum**, all the objects radiate some form of thermal radiation. These types of radiations are invisible to our eyes, but infrared sensor can detect these radiations.

The emitter is simply an IR LED **(Light Emitting Diode**) and the detector is simply an IR photodiode. Photodiode is sensitive to IR light of the same wavelength which is emitted by the IR LED. When IR light falls on the photodiode, the resistances and the output voltages will change in proportion to the magnitude of the IR light received.

There are five basic elements used in a typical infrared detection system: an infrared source, a transmission medium, optical component, infrared detectors or receivers and signal processing. Infrared lasers and Infrared LEDs of specific wavelength used as infrared sources.

The three main types of media used for infrared transmission are vacuum, atmosphere and optical fibres. Optical components are used to focus the infrared radiation or to limit the spectral response.

Types of IR Sensor

There are two types of IR sensors are available and they are,

- Active Infrared Sensor
- Passive Infrared Sensor

Active Infrared Sensor

Active infrared sensors consist of two elements: infrared source and infrared detector. Infrared sources include the LED or infrared **laser diode**. Infrared detectors include photodiodes or phototransistors. The energy emitted by the infrared source is reflected by an object and falls on the infrared detector.

Passive Infrared Sensor

Passive infrared **sensors** are basically Infrared detectors. Passive infrared sensors do not use any infrared source and detector. They are of two types: quantum and thermal. Thermal infrared sensors use infrared energy as the source of heat. **Thermocouples**, pyroelectric detectors and bolometers are the common types of thermal infrared detectors. Quantum type infrared sensors offer higher detection performance. It is faster than thermal type infrared detectors. The photo sensitivity of quantum type detectors is wavelength dependent.

IR Sensor Working Principle

There are different types of infrared transmitters depending on their wavelengths, output power and response time. An IR sensor consists of an IR LED and an IR Photodiode, together they are called as Photocoupler or Optocoupler.

IR Transmitter or IR LED

Infrared Transmitter is a light emitting diode (LED) which emits infrared radiations called as IR LED's. Even though an IR LED looks like a normal LED, the radiation emitted by it is invisible to the human eye.

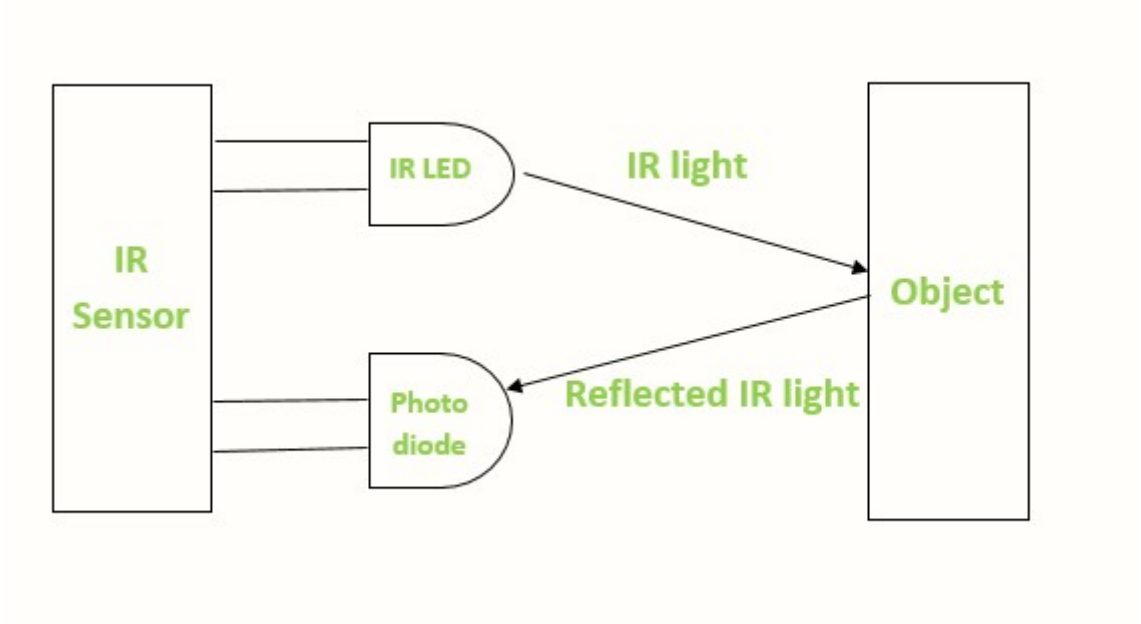
The picture of an Infrared LED is shown below.

IR Receiver or Photodiode

Infrared receivers or infrared sensors detect the radiation from an IR transmitter. IR receivers come in the form of photodiodes and phototransistors. Infrared Photodiodes are different from normal photo diodes as they detect only infrared radiation. Below image shows the picture of an IR receiver or a photodiode,

Different types of IR receivers exist based on the wavelength, voltage, package, etc. When used in an infrared transmitter – receiver combination, the wavelength of the receiver should match with that of the transmitter.

The emitter is an IR LED and the detector is an IR photodiode. The IR photodiode is sensitive to the IR light emitted by an IR LED. The photo-diode's resistance and output voltage change in proportion to the IR light received. This is the underlying working principle of the IR sensor.



When the IR transmitter emits radiation, it reaches the object and some of the radiation reflects back to the IR receiver. Based on the intensity of the reception by the IR receiver, the output of the **sensor** defines.

Applications of IR Sensor

IR sensors use in various projects and also in various electronic devices. They all are as follow,

Night Vision Devices

An Infrared technology implemented in **night vision equipment** if there is not enough visible light available to see unaided. Night vision devices convert ambient photons of light into electrons and then amplify them using a chemical and electrical process before finally converting them back into visible light.

Radiation Thermometers

IR sensos uses in radiation **thermometers** to measure the temperature depend upon the temperature and the material of the object and these thermometers have some of the following features

- Measurement without direct contact with the object
- Faster response
- Easy pattern measurements

Infrared Tracking

An Infrared tracking or Infrared homing, is a missile guidance system which operates using the infrared **electromagnetic radiation** emitted from a target to track it.

IR Imaging Devices

IR image device is one of the major applications of IR waves, primarily by virtue of its property that is not visible. It uses for thermal imagers, **night vision devices** etc.

Other Key Application Areas

Other key application areas that use infrared sensors include:

- Climatology
- Meteorology
- Photobiomodulation
- Flame Monitors
- Gas detectors
- Water analysis
- Moisture Analysers
- Anaesthesiology testing
- Petroleum exploration
- Rail safety
- Gas Analysers

DC 5 VOLT RELAY

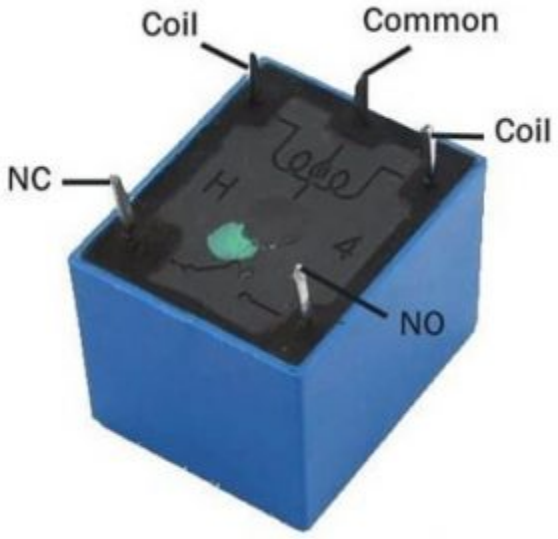
Relay is one kind of electro-mechanical component that functions as a switch. The relay coil is energized by DC so that contact switches can be opened or closed. A single channel 5V relay module generally includes a coil, and two contacts like normally open (NO) and normally closed (NC). This article discusses an overview of the 5V relay module & its working but before going to discuss what is relay module is, first we have to know what is relay and its pin configuration.

What is a 5V Relay?

A 5v relay is an automatic switch that is commonly used in an automatic control circuit and to control a high-current using a low-current signal. The input voltage of the relay signal ranges from 0 to 5V.

5V Relay Pin Configuration

The pin configuration of the 5V relay is shown below. This relay includes 5-pins where each pin and its functionality are shown below.



Relay Pin Diagram

Pin1 (End 1): It is used to activate the relay; usually this pin one end is connected to 5Volts whereas another end is connected to the ground.
Pin2 (End 2): This pin is used to activate the Relay.
Pin3 (Common (COM)): This pin is connected to the main terminal of the Load to make it active.
Pin4 (Normally Closed (NC)): This second terminal of the load is connected to either NC/ NO pins. If this pin is connected to the load then it will be ON before the switch.
Pin5 (Normally Open (NO)): If the second terminal of the load is allied to the NO pin, then the load will be turned off before the switch.

Features

The **features of the 5V relay** include the following.

- Normal Voltage is 5V DC

- Normal Current is 70mA
- AC load current Max is 10A at 250VAC or 125V AC
- DC load current Max is 10A at 30V DC or 28V DC
- It includes 5-pins & designed with plastic material
- Operating time is 10msec
- Release time is 5msec
- Maximum switching is 300 operating per minute
- um current is 10A

Working

The relay uses the current supply for opening or closing switch contacts. Usually, this can be done through a coil to magnetize the switch contacts & drags them jointly once activated. A spring drives them separately once the coil is not strengthened.

By using this system, there are mainly two benefits, the first one is, the required current for activating the relay is less as compared to the current used by relay contacts for switching. The other benefit is, both the contacts & the coil are isolated galvanically, which means there is no electrical connection among them.

Advantages

The **advantages of the relay** include the following.

- A remote device can be controlled easily
- It is triggered with less current but it can also trigger high power machines
- Easily contacts can be changed

- At a time, several contacts can be controlled using a single signal
- Activating part can be isolated
- It can switch AC or DC
- At high temperatures, it works very well

Disadvantages

The **disadvantages of the relay** include the following.

- When contacts of relay modules are used overtime then they may damage
- Noise can be generated through the opening & closing of the contacts.
- Time taken for switching is High

Applications

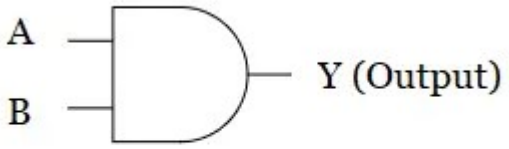
Relay are used in different applications which include the following.

- Used in over voltage/under voltage protection system
- Mains Switching
- Speed control of motors through start-delta converters
- Automatic electrical appliances
- Electrical isolation in between high & low power sources
- Lights
- AC voltage load switching using less voltage DC
- Delivery of Isolated power
- Home automation projects
- Switching with High Current

AND GATE IC 7408

- AND Gate is one of the Basic logic gates that we are using in Digital Electronics.
- AND is one of the logic operators. It performs the logical multiplication on its inputs.
- The output is high (Y=1) if and only if all the inputs to the gate are high (1).
- The output is low (0) if at least one of the inputs is low (0).
- AND gate can have two or more inputs and only one output.

- The logical symbol of two inputs AND Gate is shown in the figure below. A and B are the inputs while Y is the output.



Logical Symbol

- The truth table of two inputs AND Gate is also shown in the figure.
- Note that the output is HIGH only when both the inputs are HIGH.

Truth Table

Inputs		Output
A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

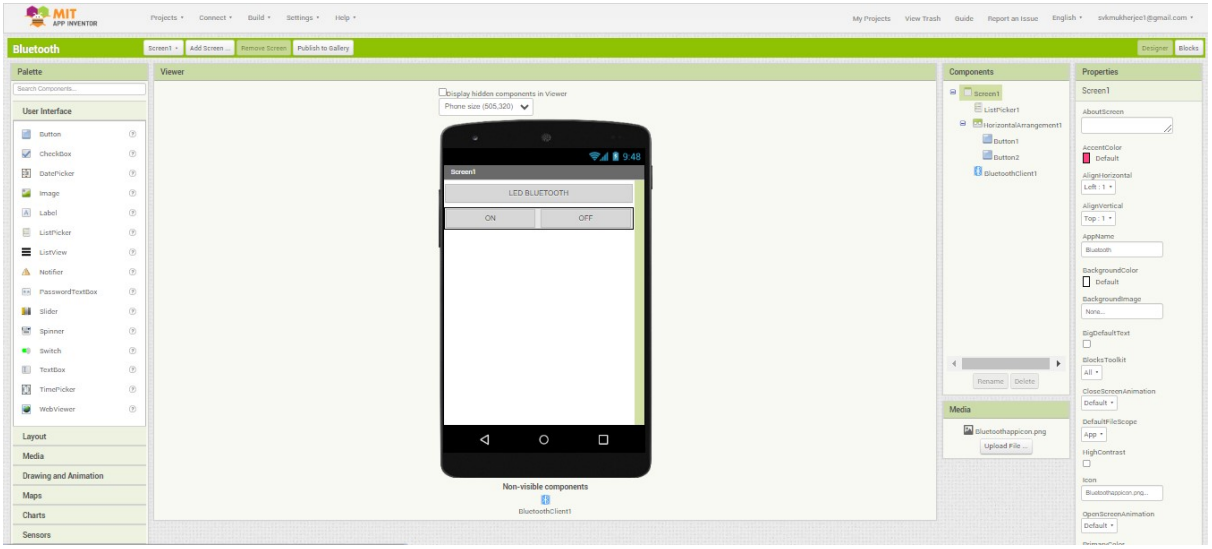
- The expression relating the inputs and output of a logic gate is called the **Boolean Expression.**
- The Boolean Expression of AND gate is,

$$\mathbf{Y=A\cdot B}$$

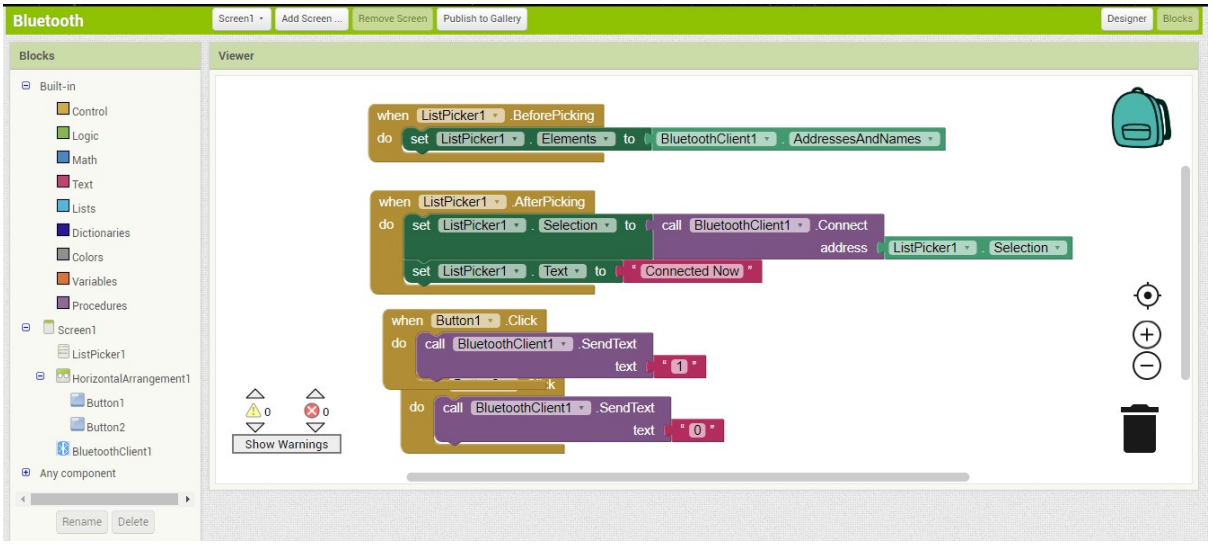
where the “dot” between A and B represents multiplication.

- By substituting different values of A and B into the Boolean expression we can get the corresponding state of the output. This is how we can verify the truth table of the gate.

THE MOBILE APPLICATION



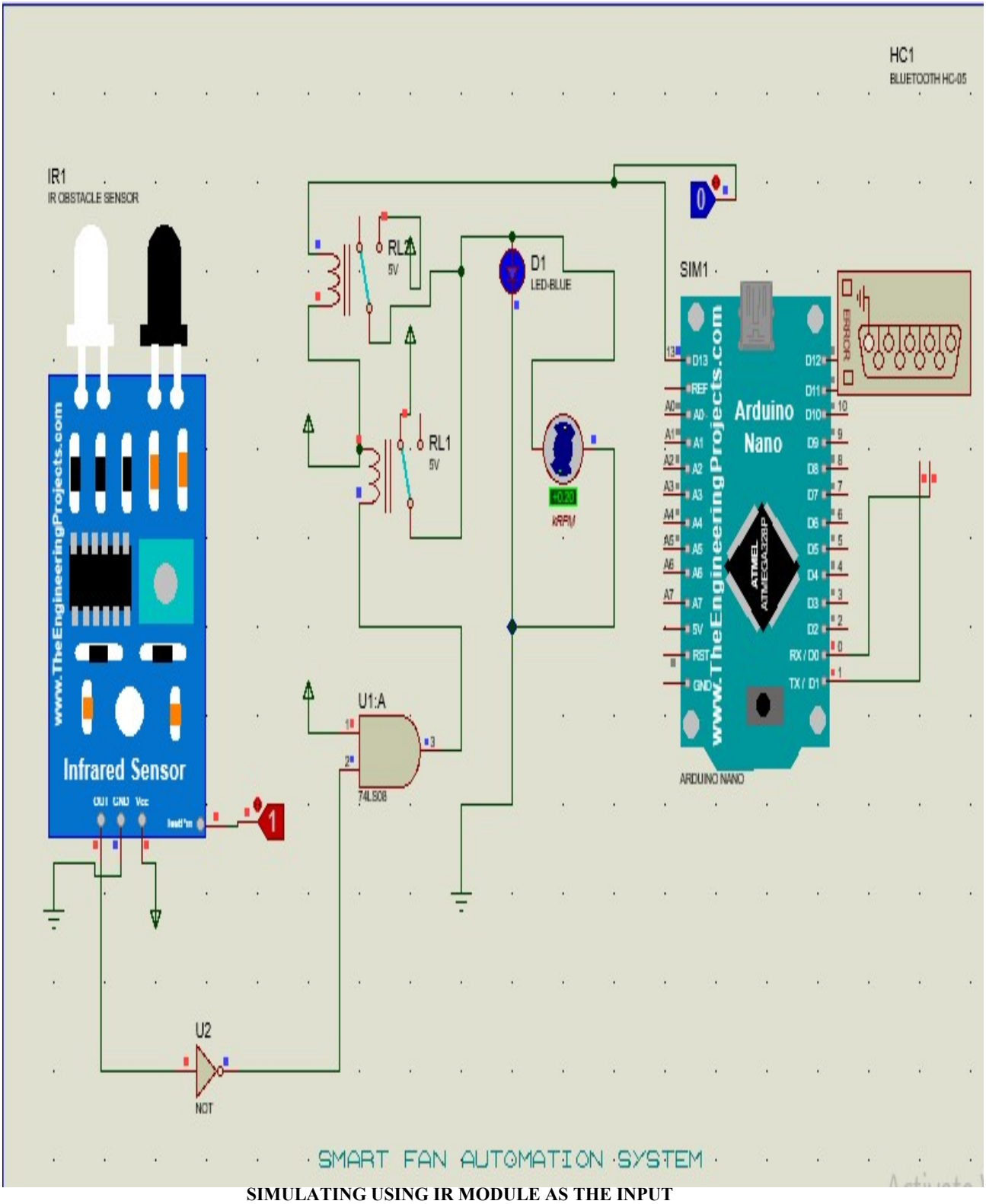
The Front-end of the mobile application during development on MIT APP INVENTOR



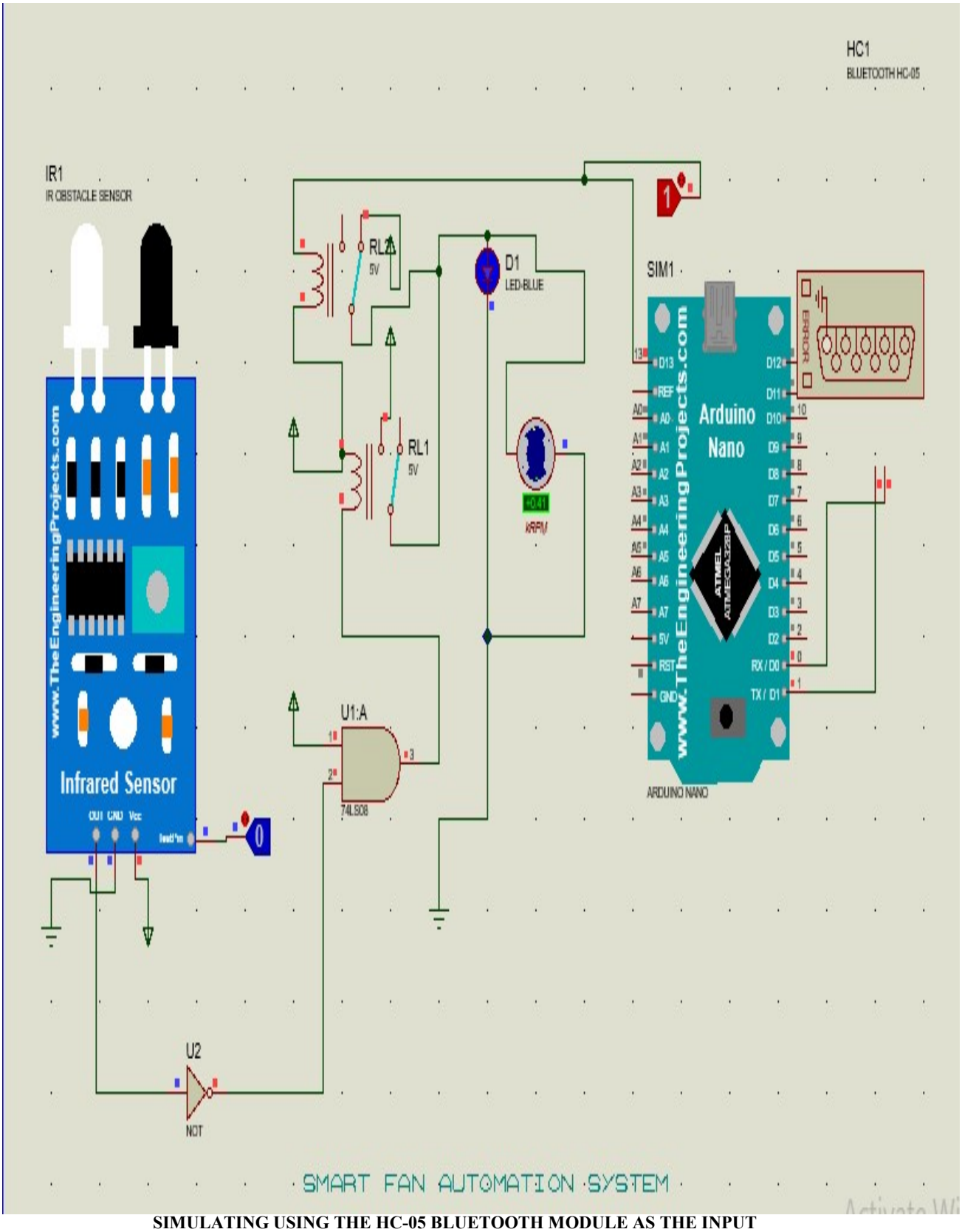
The block logic of the application in the Back-end

Just Scan the QR code to download the application and here we go!!

THE CIRCUT SCHEMATIC



SIMULATING USING IR MODULE AS THE INPUT

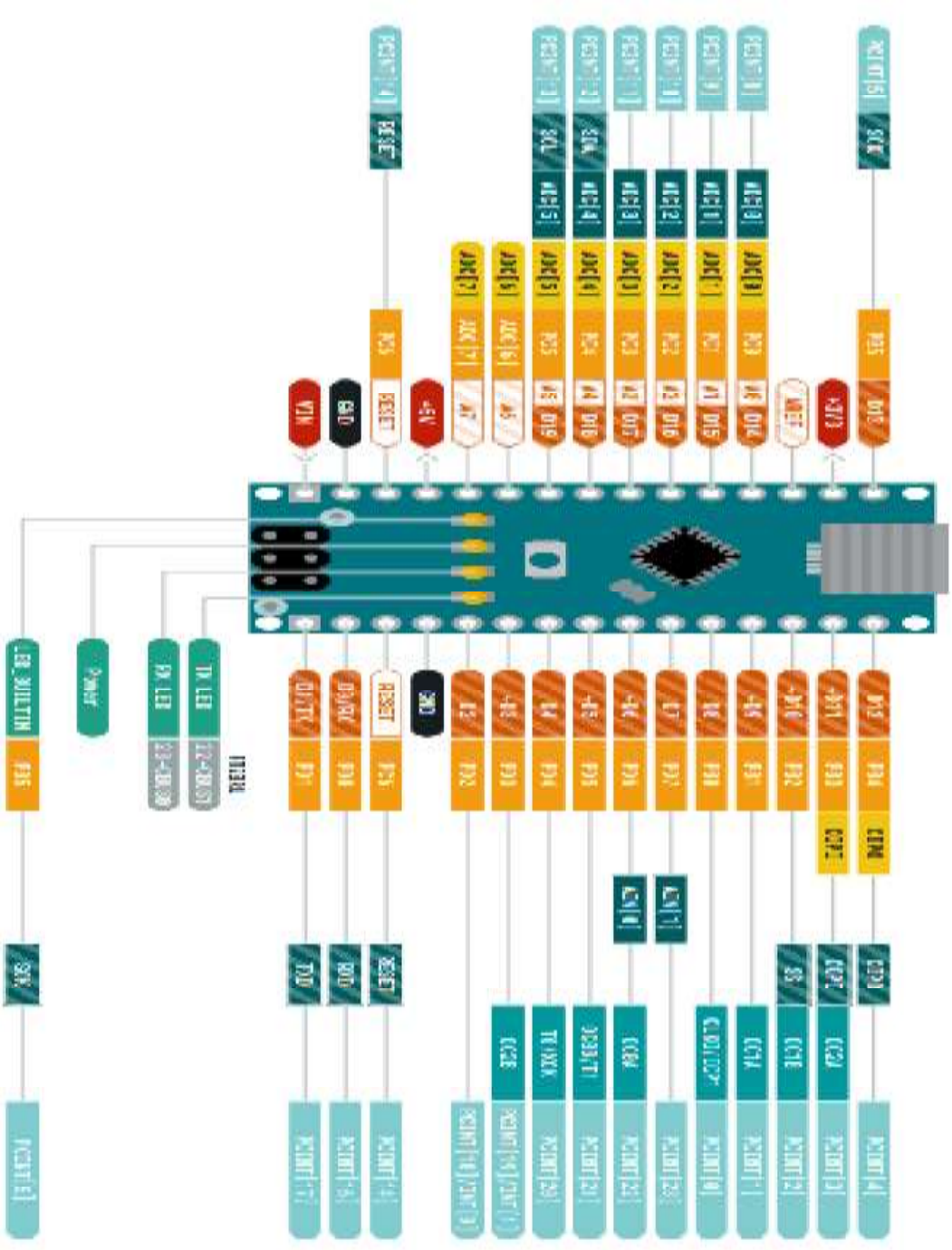


SIMULATING USING THE HC-05 BLUETOOTH MODULE AS THE INPUT

THE CODE FOR INTERFACING BLUETOOTH MODULE HC-05 WITH ARDUINO NANO

```
char Incoming_value = 0;


void setup() {
  Serial.begin(9600);
  pinMode(13,OUTPUT);// put your setup code here, to run once:


}


void loop() {
  if(Serial.available()>0)
  {
    Incoming_value = Serial.read();
    Serial.print(Incoming_value);
    Serial.print("\n");
    if(Incoming_value == '1')
     digitalWrite(13,HIGH  );
    else if(Incoming_value == '0')
     digitalWrite(13,LOW);


  }
  // put your main code here, to run repeatedly:


}
```

ARDUINO NANO PIN LAYOUT



✧✧✧✧WORKING PRINCIPLE✧✧✧✧

As it is visible from the given Schematic, a 5 volt DC fan is fitted in parallel connection to the LED that is situated across the output of the two 5V DC Relays. One Relay is input from the D13 pin of Digital GPIO section of the Arduino Nano and the Other Relay gets its input from the 7408 AND gate IC where the two inputs are the output of the IR Sensor output and the +5v Power supply.

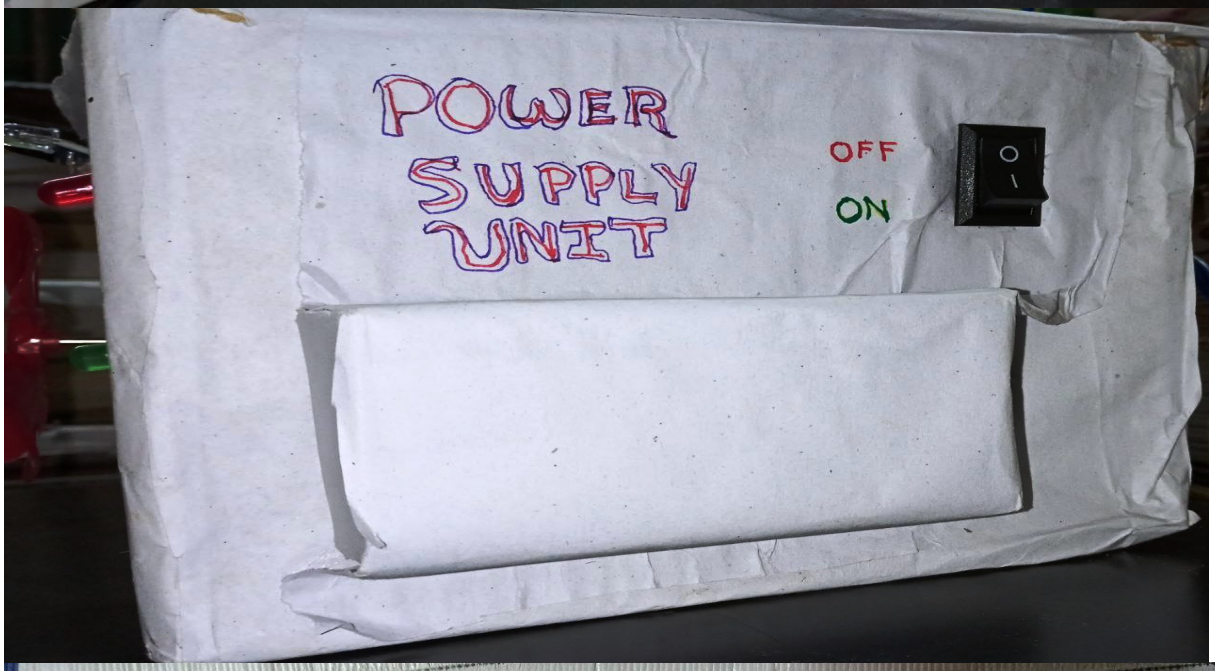
The point that must be noted is that the Relay used at the output of the IR Sensor has been setup differently with respect to the other one as the former one has its input connection across its Normally Open(NO) terminal compared to other one where the Arduino Nano Output is interfaced with the Normally Closed(NC) terminal in the reverse manner. Whenever there is a ground(-ve) signal incoming from the AND gate output, following its configuration as the other input is with the power supply of 5 V ,the relay becomes Normally Closed completing the Circuit and lighting the LED up as well as supplying a 5V output Signal to the DC motor making it rotate. On the other hand, the Relay from the output of the Arduino Nano in D13 is interfaced as such the moment the output of the Arduino Nano is High, the later Relay's common terminal shifts to Normally Closed terminal due to the other input of this very Relay being High and this process helps the completion of the circuit path glowing the LED up and the Motor having parallel connection to the LED also gets supplied a voltage of 5V that makes it to get rotating and stops when the is no supply.

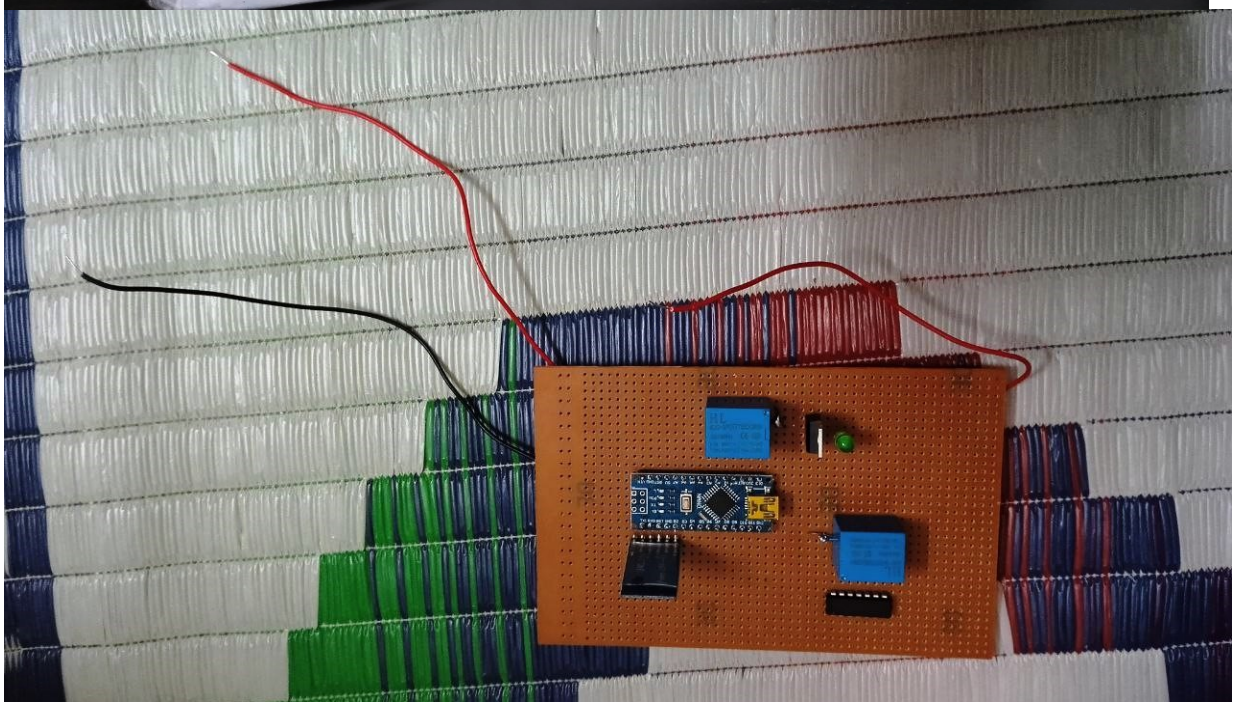
When we use the "Bluetooth" Mobile Application to send signal to the Arduiono, the mediator here is the very Bluetooth HC-05 module that works at 9600 baud rate through the D1(Tx) and D0 (Rx) serial communication pins of the Arduino Nano .In this way the Fan can be Automated with the help of IR Sensor Module or can be manually controlled with the help of Mobile Control using the Bluetooth Application within the range of 30 feet or 10 meters.

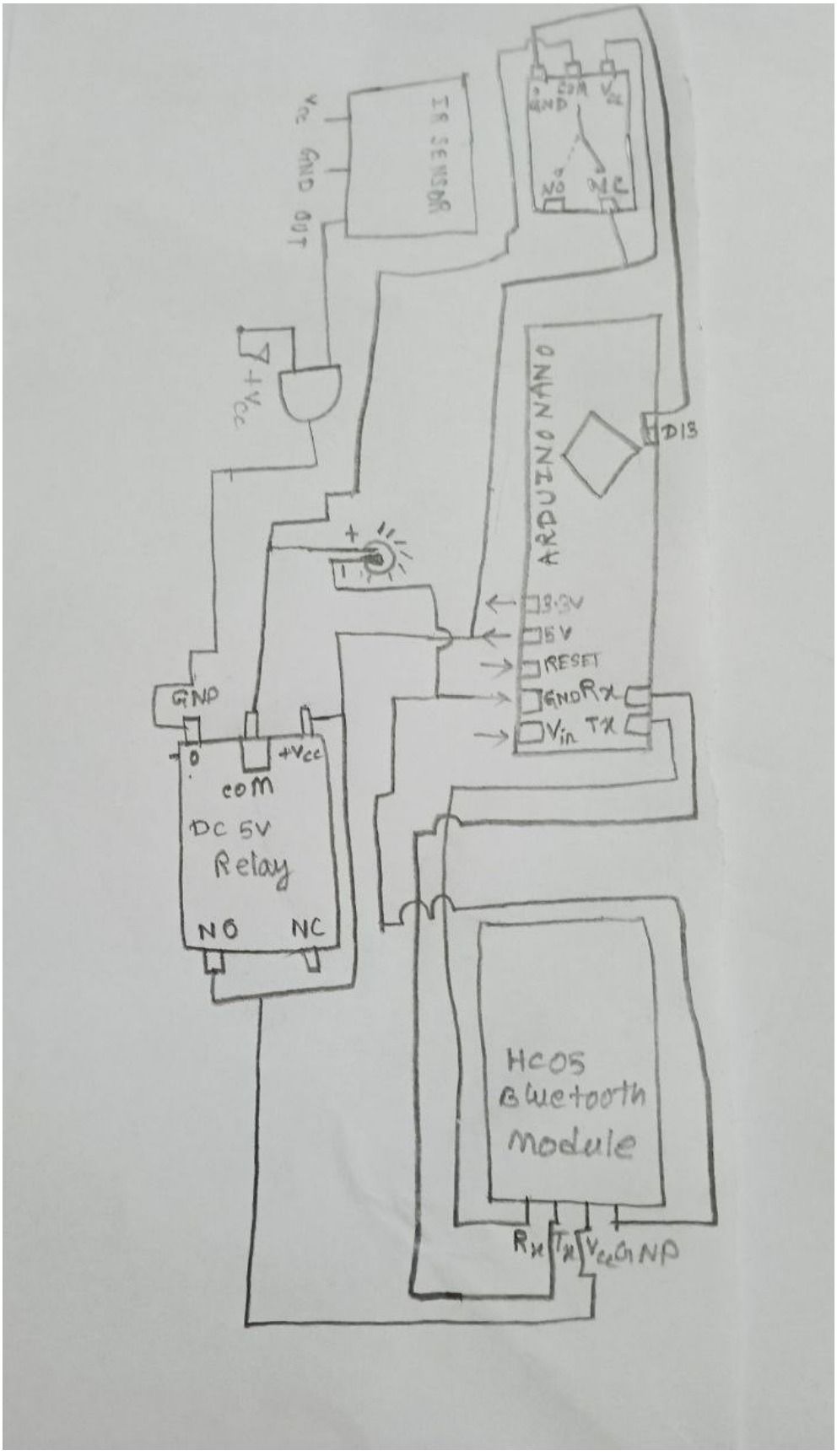
THE COMPONENT COSTS

Serial No	COMPONENT NAME	Cost
1	Arduino Nano	220
2	HC-05 Module	190
3	SPST Switch	20
4	9 Volt Battery	50
5	Relay	40
6	Verro Board	60
7	IR Sensor	30
8	And Gate IC-7408	45
9	Voltage Regulator 7805	20
10	Battery Connector	12
11	5 volt DC Fan Model	50
12	Arduino Nano USB Cable	200
13	Single Strand Wire	20
14	LED	10
15	Tape	15
16	Total	982


SMART
FAN
AUTOMATION
POWER ON
SIGNAL ON


POWER
SUPPLY
UNIT
OFF
ON




COM
GND
NO
NC
Vcc
GND OUT
IR SENSOR
+Vcc
ARDUINO NANO
D13
3.3V
5V
RESET
GND
Rx
Vin
Tx
GND
+Vcc
COM
DC 5V
Relay
NO
NC
HC05
Bluetooth
module
Rx
Tx
Vcc
GND