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Project On Internet of Things

Smart Ceremonial Lamp

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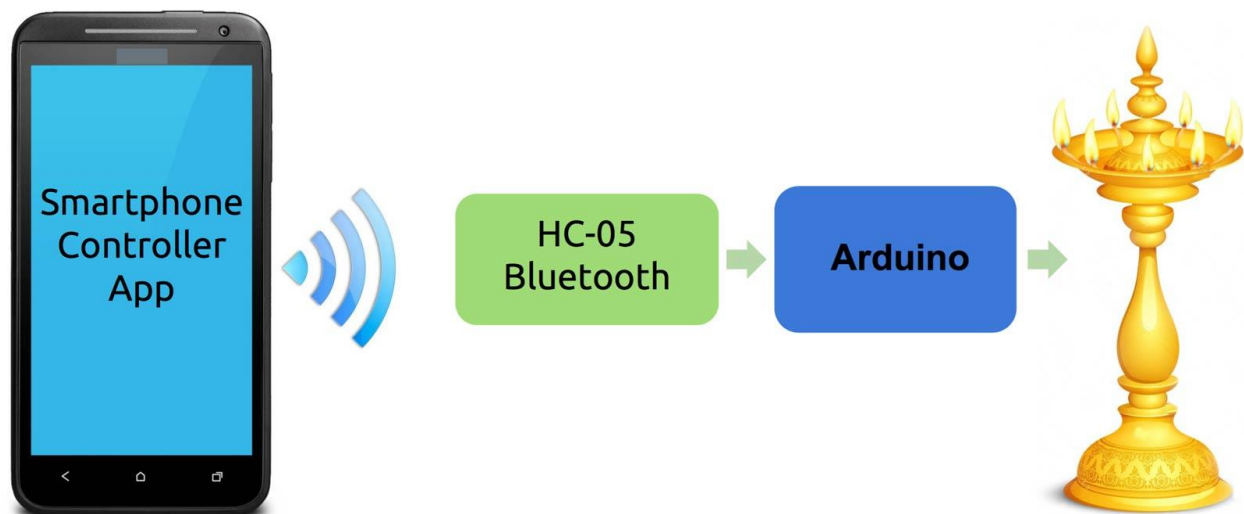
Abstract:

In India, the ancient tradition of lighting oil lamps has a special significance. Almost all auspicious ceremonies are commenced by lightning of a lamp. Hence came the idea of merging our traditional culture with the digital world using this “Smart Ceremonial Lamp”.

Our project “Smart Ceremonial Lamp” is to spunk up your events or ceremonies by controlling a series of LEDs using an Arduino through bluetooth via a smartphone Bluetooth terminal app. The product is readily acceptable to the user since the only pre-requisite is an android smartphone with Bluetooth technology. It aims at creating something interesting, easy, quick and new for our inaugural ceremony.

The process involves several stages. First step is to connect your Arduino to the HC-05 bluetooth module and LEDs as per the connection diagram. Second Step is to create a smartphone app for our “Smart Ceremonial Lamp”. Also, a simpler way for controlling our Smart Lamp is to download the bluetooth terminal app from the play store. Both of them work the same way by sending the appropriate commands to Arduino. The only main difference will be by making our own app we can make its appearance and use according to our suitability. Step three is to upload the code for Arduino. The last step involves making of the lamp stand using wooden sheets and PVC pipes. Now, connect the LEDs and bluetooth module to the arduino and place all the hardware inside the bowl. Place the bowl on top of the pipe. We used a power bank to power the system and also covered it from plain sight.

The basic functioning of the project can be demonstrated by the following image.



Objective:

The main objective of our “Smart Ceremonial Lamp” is to spunk up your events or ceremonies by controlling a series of LEDs using an Arduino through Bluetooth via a smartphone Bluetooth terminal app.

Project Need/Motivation:

“Knowledge removes ignorance, just as light removes darkness”, as it is wisely said. In India, the ancient tradition of lighting oil lamps has a special significance. Almost all auspicious ceremonies are commenced by lightning of a lamp. Hence came the idea of merging our traditional culture with the digital world using this “Smart Ceremonial Lamp”. We did this by lighting a series of LEDs wirelessly on an oil lamp by using a smartphone app.

In a world full of innovation, it is easy to fall in love with ideas. Nowadays a new emerging technology is **Internet of Things (IoT)**: in other words all the physical objects (things) are connected together using internet infrastructure. IoT aims at designing and creating ideation, business generation and hardware prototyping tools, which allow you to discover the most impactful way to develop connected products and services.

The Internet of Things is a scenario in which objects, animals or people are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. First, there’s the underlying technology, the various wireless radios that allow these devices to connect to the Internet and to each other. These include more familiar standards like Wi-Fi, low-energy Bluetooth, NFC and RFID, and some that you’ve probably haven’t heard of, like ZigBee, Z-Wave etc. Then there are the things themselves, whether they’re motion sensors, door locks or light bulbs. In some cases, there may also be a central hub that allows different devices to connect to one another. Finally, there are cloud services, which enable the collection and analysis of data so people can see what’s going on and take action via their mobile apps.

Arduino is one of the most important object in this ecosystem to create smart objects and automate our life, homes etc. Arduino is an open-source electronics prototyping platform based on flexible, easy-to-use hardware and software. It’s intended for artists, designers, hobbyists, and anyone interested in creating interactive objects or environments.

Hence combining these two technologies would bring up a great and a promise to a better future. By doing so, we believe that we are upholding our tradition as well as trying to do something fun and innovative.

Similar Works:

- **Controlling AC lights using Arduino-** This project uses Arduino along with relay to control AC lights. AC is alternating current 220v (India) which powers the ac lights. Arduino cannot control high voltage, but a relay can do this job, which is the sole design of it. So relay is used as switch to control high power devices.
- **Arduino Clap Sensitive Light Control-** A simple clap-on/clap-off circuit using Arduino. The schematic is simple, and the components are easy and inexpensive to acquire such as 6x components, and an Arduino UNO. The circuit acts to simply toggle an LED on and off for every clap. You can use a relay circuit instead if you'd like, or you can simply write the code and manipulate for your specific application. You can easily calibrate the sensitivity in the code to your level of satisfaction, and the circuit can be put together in minutes.
- **Capacitive Touch Arduino Lamp-** The capacitive Sensor library turns two or more Arduino pins into a capacitive sensor, which can sense the electrical capacitance of the human body. All the sensor setup requires is a medium to high value resistor and a piece of wire and a small (to large) piece of aluminum foil on the end. At its most sensitive, the sensor will start to sense a hand or body inches away from the sensor. Capacitive sensing may be used in any place where low to no force human touch sensing is desirable. An Arduino and the library may be used to sense human touch through more than a quarter of an inch of plastic, wood, ceramic or other insulating material (not any kind of metal though), enabling the sensor to be completely visually concealed. This feature can be used to build a capacitive touch Arduino lamp.
- **Mood Lamp with Arduino-** This project is about how to construct and code an ambient LED light using an Arduino board and some common circuit components. This project mixes a red, green, and blue LED to get a wide range of colors, and the Arduino cycles through them. The paper cover is used to diffuse the light from the discrete LEDs into a more uniform hue. This project is ideal to add some mood lighting to a dark room using the Arduino and some common, cheap materials.

Requirements Specification:

Our project “Smart Ceremonial Lamp” fulfills all the requirements of the users while using the minimal resources. It is to spunk up your events or ceremonies by controlling a series of LEDs using an Arduino through bluetooth via a smartphone Bluetooth terminal app. The product is readily acceptable to the user since the only pre-requisite is an android smartphone with Bluetooth technology. The aim of our project is to create something interesting, easy, quick and new for our inaugural ceremony.

Several requirements of the user which can be fulfilled using the “Smart Ceremonial Lamp” are as follows:

- Reduced Installation Costs
- System Scalability and Easy Extension
- Aesthetical Benefits
- Digitalization

Input Sets and Source:

Input Sets- The input sets are provided into the Bluetooth Terminal App. They can be categorized into two:-

1) Turning ON LEDs-

LEDs	Input (in Hexadecimal)
LED 1	1
LED 2	2
LED 3	3
LED 4	4
LED 5	5

2) Turning OFF LEDs

LEDs	Input (in Hexadecimal)
LED 1	6
LED 2	7
LED 3	8
LED 4	9
LED 5	A

Input Sources- These sources can be any one of the following:

- Power bank- Capacity: 2200 mAh
Input: DC 5V/ 1000mA
Output: DC 5.3V/2.5A (max)
- Laptop
- 5V DC battery

Targeted Output Sets:

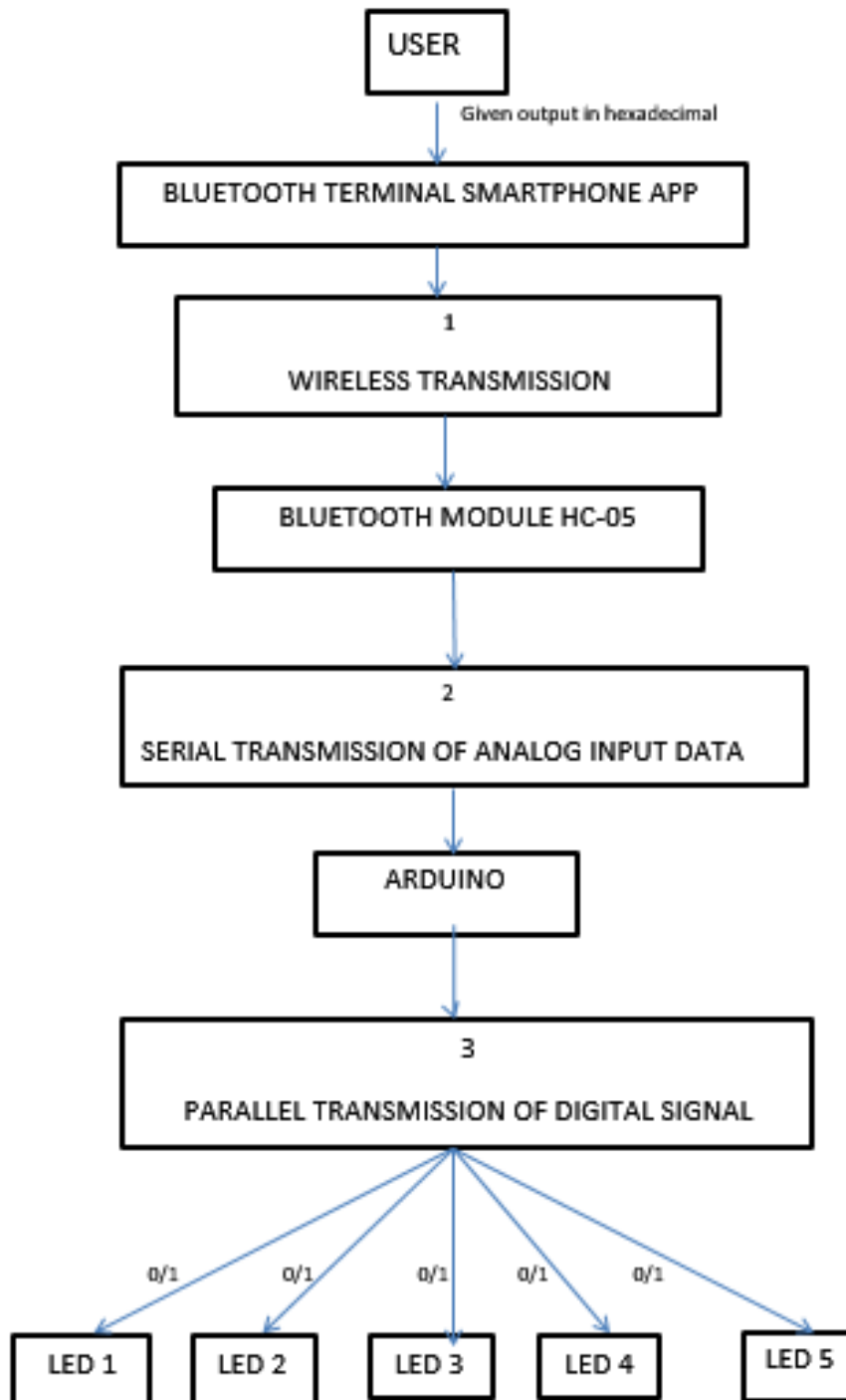
1) Turning ON LEDs-

Input (in Hexadecimal)	Targeted LEDs
1	LED 1
2	LED 2
3	LED 3
4	LED 4
5	LED 5

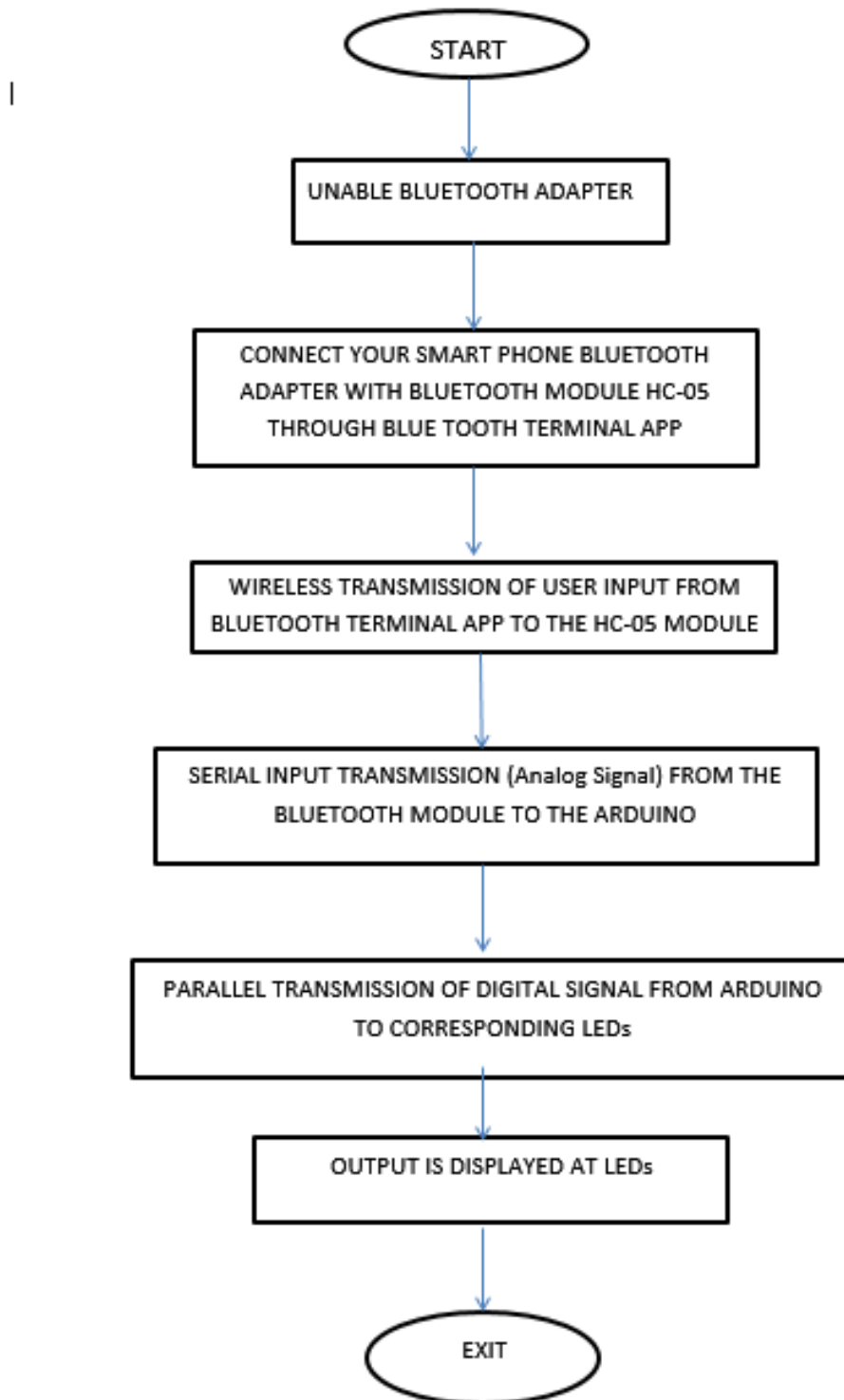
2) Turning OFF LEDs-

Input (in Hexadecimal)	Targeted LEDs
6	LED 1
7	LED 2
8	LED 3
9	LED 4
A	LED 5

Data Flow Model:



Process Flow Model:



Hardware Requirement and Limitations:

Hardware and other materials required for the project are as follows-

1. Arduino Uno
2. HC-05 Bluetooth module
3. LEDs
4. Connecting wires
5. Plastic bowl
6. PVC pipes
7. Wood (for making the base. you can use any other alternatives too)
8. Power bank or power source

Limitations-

1. Arduino does not have an operating system of its own. We need to use the Arduino on Windows or Mac OS unlike Raspberry Pi.
2. The Arduino team has really made it pretty easy to use the ATmega chips but with ease of use they have traded away some performance optimizations. A skilled programmer might get better performance out of the chip by writing their own code.
3. The layout of the pins had an error and this has perpetuated itself in the name of maintaining compatibility. It just makes it a bit harder to line it up with any associated boards you might want to use that are not designed with Arduino in mind.
4. In order to add an additional feature of Bluetooth connectivity an extra Bluetooth module is also required which costs more than the Arduino board itself.
5. Again if we want to do additional features like video streaming, Ethernet connection, etc we need to buy extra shields that will cost extra and sometimes the shield will cost more than the Arduino board itself.
6. Bluetooth technology has certain limitations such as-
 - Distance limitations
 - Interference
 - Slow transfer rate
 - Transfer small amounts of data at a time.

Data sheet and Fact sheet of Components:

1. Arduino Uno-

Technical Specifications:

Microcontroller	ATmega328P
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limit)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
PWM Digital I/O Pins	6
Analog Input Pins	6
DC Current per I/O Pin	20 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (ATmega328P) of which 0.5 KB used by bootloader
SRAM	2 KB (ATmega328P)
EEPROM	1 KB (ATmega328P)
Clock Speed	16 MHz
LED_BUILTIN	13
Length	68.6 mm
Width	53.4 mm
Weight	25 g

2. Bluetooth HC-05 Module-

Hardware Features:

- Typical -80dBm sensitivity
- Up to +4dBm RF transmit power
- Low Power 1.8V Operation ,1.8 to 3.6V I/O
- PIO control
- UART interface with programmable baud rate
- With integrated antenna
- With edge connector

Software Features:

- Default Baud rate: 38400, Data bits:8, Stop bit:1,Parity:No parity, Data control: has. Supported baud rate: 9600,19200,38400,57600,115200,230400,460800
- Given a rising pulse in PIO0, device will be disconnected.
- Status instruction port PIO1: low-disconnected, high-connected;
- PIO10 and PIO11 can be connected to red and blue led separately. When master and slave are paired, red and blue led blinks 1time/2s in interval, while disconnected only blue led blinks 2times/s.
- Auto-connect to the last device on power as default.
- Permit pairing device to connect as default.
- Auto-pairing PINCODE:"0000" as default
- Auto-reconnect in 30 min when disconnected as a result of beyond the range of connection.

Pin Description of HC-05 Bluetooth Module-

PIN Name	PIN #	Pad type	Description
GND	13 21 22	VSS	Ground pot
3.3 VCC	12	3.3V	Integrated 3.3V (+) supply with On-chip linear regulator output within 3.15-3.3V
AIO0	9	Bi-Directional	Programmable input/output line
AIO1	10	Bi-Directional	Programmable input/output line
PIO0	23	Bi-Directional RX EN	Programmable input/output line, control output for LNA(if fitted)
PIO1	24	Bi-Directional TX EN	Programmable input/output line, control output for PA(if fitted)
PIO2	25	Bi-Directional	Programmable input/output line
PIO3	26	Bi-Directional	Programmable input/output line
PIO4	27	Bi-Directional	Programmable input/output line
PIO5	28	Bi-Directional	Programmable input/output line
PIO6	29	Bi-Directional	Programmable input/output line
PIO7	30	Bi-Directional	Programmable input/output line
PIO8	31	Bi-Directional	Programmable input/output line
PIO9	32	Bi-Directional	Programmable input/output line
PIO10	33	Bi-Directional	Programmable input/output line
PIO11	34	Bi-Directional	Programmable input/output line

Coding for Hardware:-

Here we are using Arduino and Bluetooth module (HC-05) as a hardware. The code for Arduino is very simple. It checks for characters like “1”, “2”, etc. through the bluetooth serial module HC-05. Corresponding LEDs are then turned ON and OFF based on each command. This is the code:

```
int state;

int pin1=8;
int pin2=9;
int pin3=10;
int pin4=11;
int pin5=12;

void setup(){
  pinMode(8, OUTPUT);
  pinMode(9, OUTPUT);
  pinMode(10, OUTPUT);
  pinMode(11, OUTPUT);
  pinMode(12, OUTPUT);
  Serial.begin(9600);
}

void loop(){
  if (Serial.available()>0)
  {
    state = Serial.read();
```

```
if(state == '1')  
{  
  digitalWrite(8, HIGH);  
  delay(1000);  
  state=0;  
}
```

```
if(state == '2')  
{  
  digitalWrite(9, HIGH);  
  delay(1000);  
  state=0;  
}
```

```
if(state == '3')  
{  
  digitalWrite(10, HIGH);  
  delay(1000);  
  state=0;  
}
```

```
if(state == '4')  
{  
  digitalWrite(11, HIGH);  
  delay(1000);  
  state=0;  
}
```



```
if(state == '5')
{
digitalWrite(12, HIGH);
delay(1000);
state=0;
}
if(state == '6')
{
digitalWrite(8, LOW);
delay(1000);
state=0;
}
if(state == '7')
{
digitalWrite(9, LOW);
delay(1000);
state=0;
}
if(state == '8')
{
digitalWrite(10, LOW);
delay(1000);
state=0;
}
```

```
if(state == '9')
{
digitalWrite(11, LOW);
delay(1000);
state=0;
}
if(state == 'A')
{
digitalWrite(12, LOW);
delay(1000);
state=0;
}
}}
```

Project Input Interface:

Bluetooth terminal:-

A simple Bluetooth communication app, using the SPP profile to transmit/receive data from a compatible, paired device. Customisable function buttons, autoscroll on/off, terminal can display ASCII and Hex. Perfect to use with RealTerm and Arduino. The app is terminal application, it can transaction data between Bluetooth device.

Features of Bluetooth Terminal are:

- Protocol: Bluetooth Specification v2.0+EDR
- Frequency: 2.4GHz ISM band
- Modulation: GFSK
- Emission power: $\leq 4\text{dBm}$, Class 2
- Sensitivity: $\leq -84\text{dBm}$ at 0.1% BER
- Speed: Asynchronous: 2.1Mbps(Max) / 160 kbps, Synchronous: 1Mbps/1Mbps
- Security: Authentication and encryption
- Profiles: Bluetooth serial port
- Power supply: +3.3VDC 50mA
- Working temperature: $-20 \sim +75$ Centigrade

Project Output Interface:-

Light Emitting Diode-

A **light-emitting diode (LED)** is a two-lead semiconductor light source. It is a p-n junction diode, which emits light when activated.^[4] When a suitable voltage is applied to the leads, electrons are able to recombine with electron holes within the device, releasing energy in the form of photons. This effect is called electroluminescence, and the color of the light (corresponding to the energy of the photon) is determined by the energy band gap of the semiconductor.

Light is a form of energy that can be released by an atom. It is made up of many small particle-like packets that have energy and momentum but no mass. These particles, called photons, are the most basic units of light. Photons are released as a result of moving electrons. In an atom, electrons move in orbitals around the nucleus. Electrons in different orbitals have different amounts of energy. Generally speaking, electrons with greater energy move in orbitals farther away from the nucleus.

Project Life and Maintenance:

The life of project will depend on the life of Arduino Bluetooth module, led and the life of power source through which we are giving power.

Maintenance means being very intentional about tracking project errors toward milestones and goals, instead of assuming everything will happen as planned. Here maintenance include changing the power source, led, Arduino. etc.. if any error occurs.

Conclusion:

The working of this project is pretty simple. By doing so, we believe that we are upholding our tradition as well as trying to do something fun and innovative. The aim of our project to create something interesting, easy, quick and new for our inaugural ceremony was successfully fulfilled.

The working of this DIY Arduino Lamp is pretty simple. The series of LEDs arranged on the lamp lights up when a command/button is pressed on the smartphone application. The Arduino powers the LEDs when the corresponding bluetooth command is received via the HC-05 bluetooth module. This project fulfills the demand of digitalization of masses while keeping in mind the economical factors.

Future Work and Timeline:-

We can extend our idea to control the entire light system of a home, office etc. A home automation system is a means that allow users to control electric appliances of varying kind. Homes of the 21st century will become more and more self-controlled and automated due to the comfort it provides, especially when employed in a private home. Thus, our project can be further extended to control the electrical and home appliances using the android operating system and Bluetooth application by using some more electronic devices such as relays.