

# Garbage Management System in Smart Cities using Automatic Robot

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**Abstract:** The fourth generation defiance demands various advanced technologies and their interactions and incorporation in human world, which definitely has moved from the era of sci-fiction and research & development towards reality. Smart cities are now acquiring, utilizing and are fully charged with impending technologies; gradually they have adopted various forms of technology in multiple areas of economic and social life sector. Robots are designed, deployed and utilized for human comfort, as robot is an emerging field in the smart city infrastructure and in its application. A garbage collecting robot can obtain information about its surrounding environment, work for more time mitigate human effort and cost. A Robot can move as per instructed by user or in an automated way which is interaction between machines and humans.

**Keywords:** Automatic Mode, Battery, Garbage Separation and Evacuation, Manual Mode, Node MCU, Robotic Arm, Smart City, Servo Motors.

## I. INTRODUCTION

Development of Science and utilisation of Advanced Technologies have shown sound impact on the day to day routine of Smart cities, Smart cities equally intricate the use of Robots, as robotic field has gained recognition to ease human labour in Today's world. We use robot to fulfil our daily needs. This gives us a glimpse of articulation of various advanced technologies and domains altogether giving a new accord to the Infrastructure of Smart cities. The field of computer science and engineering concerned with creating robots that can move and react to sensory input. Robotics is one branch of artificial intelligence. Robots are automatic machines. Robots can perform mechanical and repetitive jobs faster and more accurately than humans can. Robot having its own brain fitted with computer logic so that it can do the work according to the algorithm designed into it. Robots play an important role in each & every field. They are used at industries, factories, offices, universities, societies and houses. The robots are just becoming as intelligent as human nowadays.

Various robotics parts are-

- Actuators
- Sensors
- Mechanical control devices like motors
- Microcontroller – Arduino

Robots have all the above-described parts. Actuators are for controlling a mechanism that ultimately controls the entire unit. Sensors are sensing devices in the robot that, transmit a signal, receive the signal, and accumulate various environment information that is given to microcontroller for deciding the operations of machines. Mechanical control devices are devices used to control movement of robots using motors. Microcontroller is brain of robot wherever program is written and sensors are connected as i/p and actuators as o/p. Arduino is a Microcontroller Board, which has embedded codes used for controlling mechanical control devices.

## II. RELATED WORK

Sayli Mahadik, Ankita Chavan, Prathamesh Yerunkar presents Voice Operated Floor Cleaning Robot, a voice controlled robot which just clean the floor instead of collecting garbage on the floor, cleaning, collecting and separating is done by our system which reduced human intervention.

## III. METHODOLOGY

**Proposed System:** System has implemented into two modes using android application:

1. Manual Mode
2. Autonomous Mode

Proposed Algorithm for garbage management system in smart cities using Automatic Robot in **MANUAL MODE:**

**Step 1:** User starts the Android application.

**Step 2:** User switches to the app in manual mode, as two modes are available for robot in android application.

**Step 3:** User will command robot to start the work and move towards to the workspace.

**Step 4:** Robot as per instruction of user will move and detect the offset (detection of source i.e. Primary source location, Secondary source location) and start to collect the garbage.

**Step 5:** Robot will collect the garbage also detect the type of garbage (metallic and non-metallic)

**Step 6:** After detecting the type of garbage, it will drop it into the respective shells of the type of garbage (the garbage shell i.e. Metallic and non-metallic portion)

**Step 7:** Robot moves as per instruction, collects garbage also segregates the type of garbage and storing it into respective garbage shells, during the movement or while robot is every time filling the garbage he acknowledges the status of garbage bin, in case if the bin is full it will be notified to the user as buzzer sound.

**Step 8:** The user after hearing the buzzer, he will instructs the robot to empty the bin at nearby garbage area.

**Step 9:** Robot after vacating the garbage bin halts for further instructions, user commands him to start the activity for further cleaning.

**Step 10:** Repeat steps 5to9 until entire the workspace cleaned.

**Step 11:** The user after acknowledging that, the cleaning of entire workspace area has been accomplished; user commands the robot to move back towards the source of workspace (i.e. Primary source) and stand like dustbin on the specified area.

#### Proposed Algorithm for garbage management system in smart cities using Automatic Robot in **AUTOMATIC MODE:**

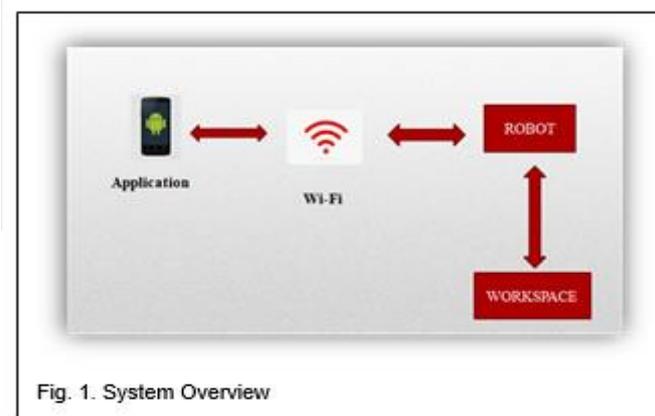
**Step 1:** Once the robot is in automatic mode it has capability to collect the garbage automatically. 6 Sensors connected to detect whether it is garbage or obstacle.

**Step 2:** One on left detects obstacles at left side and the other on right detects the obstacle on the right side. The reason why 4 sensors are connected at front is 2 sensors at the bottom will detect the garbage which is lying on the ground whereas upper 2 sensors will detect whether there is any bigger object in front of the vehicle which can be considered as an obstacle and has to be avoided.

**Step 3:** The side sensors works as follows if the distance between sensor and obstacle is less that 28cm the car should stop whereas if right distance is greater than 28cm and left distance is less than 28 the car should take a right direction and move forward and vice versa for the left direction where left distance would be more.

**Step 4:** Now when both the distance between left bottom sensor and right bottom sensor is less than 20cm and distance between top two sensors are greater than 28cm then there's the garbage that should be collected so for this condition we have saved the positions to collect the garbage in a function that is activated and garbage is collected automatically.

**System Overview:** This is overview of system architecture, which shows that an android application is used for controlling robot, which is being connected to the Wi-Fi technology. This application's Wi-Fi connection is connected with robot's Wi-Fi connection through microcontroller. Now that robot is completely connected with application and now he is ready in his workspace for cleaning the garbage area.



**Block Diagram:** This is internal structure of our project in which all the modules connected to each other is being shown. The power supply module is connected to battery, which passes the voltage to supply and to Wi-Fi module. That Wi-Fi module is connected further to the microcontroller. All servomotors and motor driver are connected to microcontroller. There are two sensors used, which are metallic proximity sensor, and ultrasonic sensor connected to microcontroller. Dc-dc step down is used for controlling voltage of the motors, which is connected to servomotors.

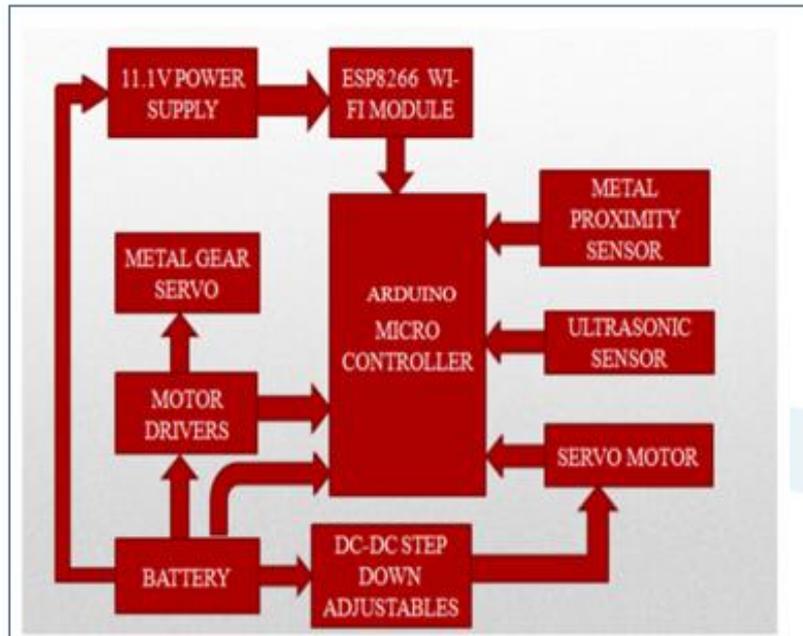
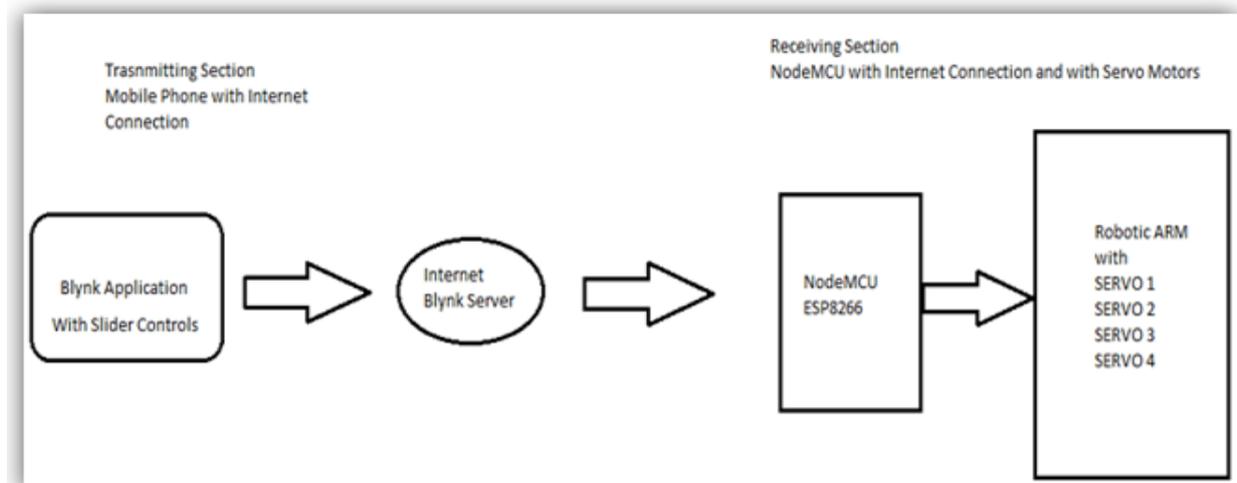


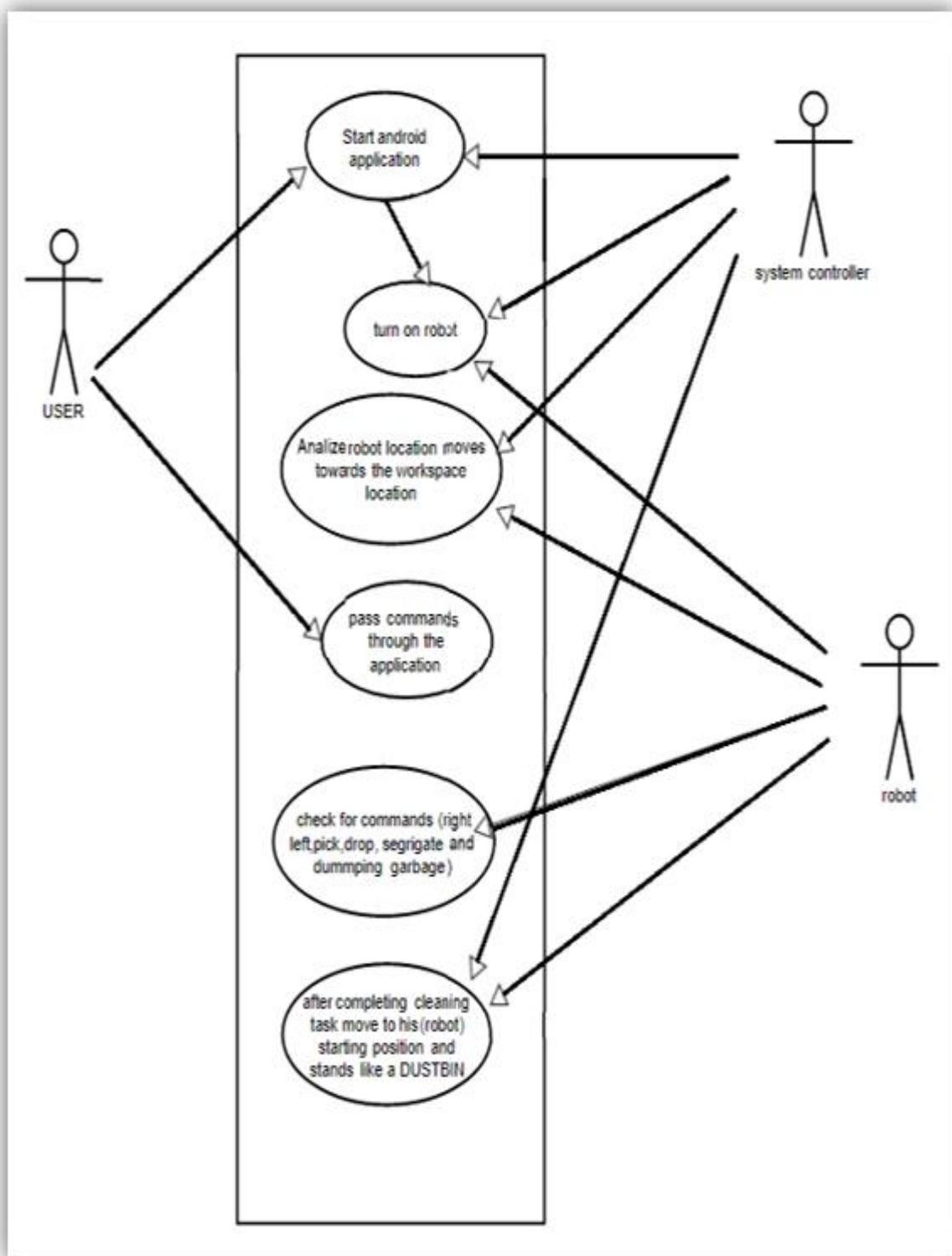
Fig. 2. Block Diagram

#### IV. DESIGN AND METHODOLOGY

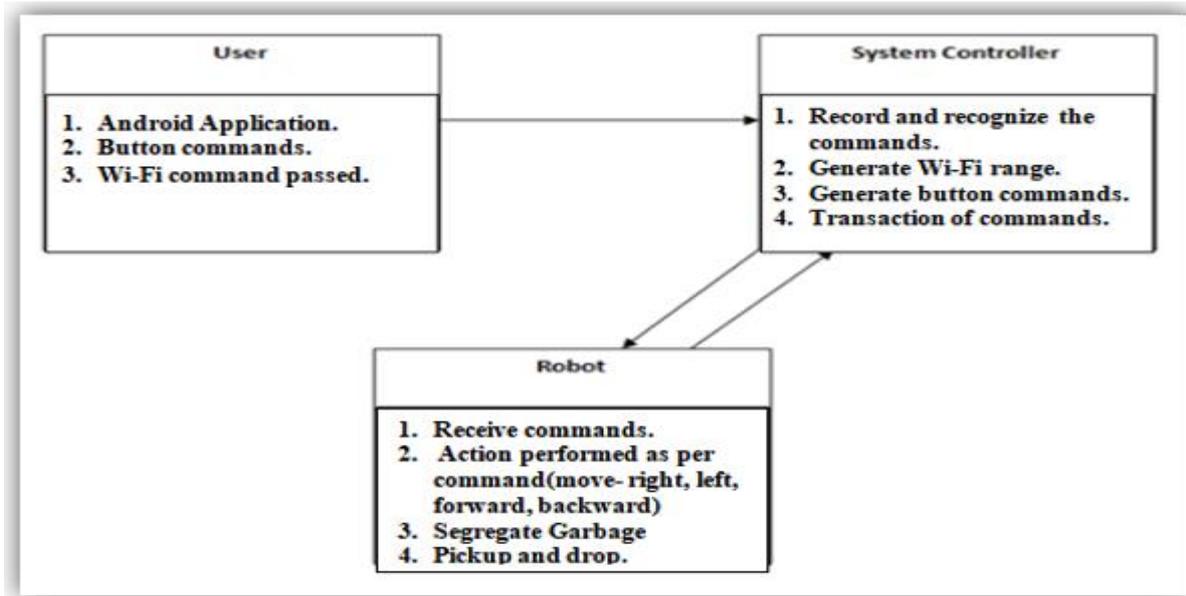
Working of Robotic Arm:



Use Case Diagram:

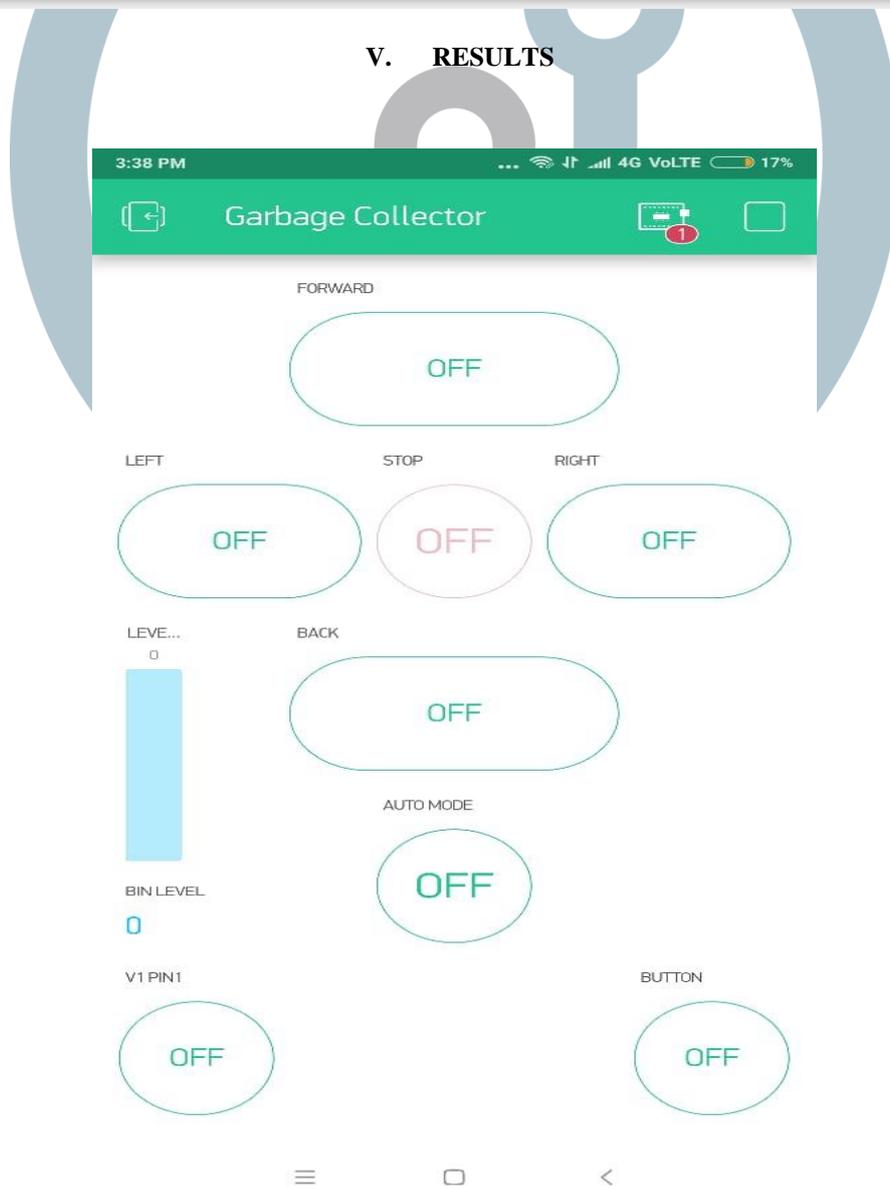


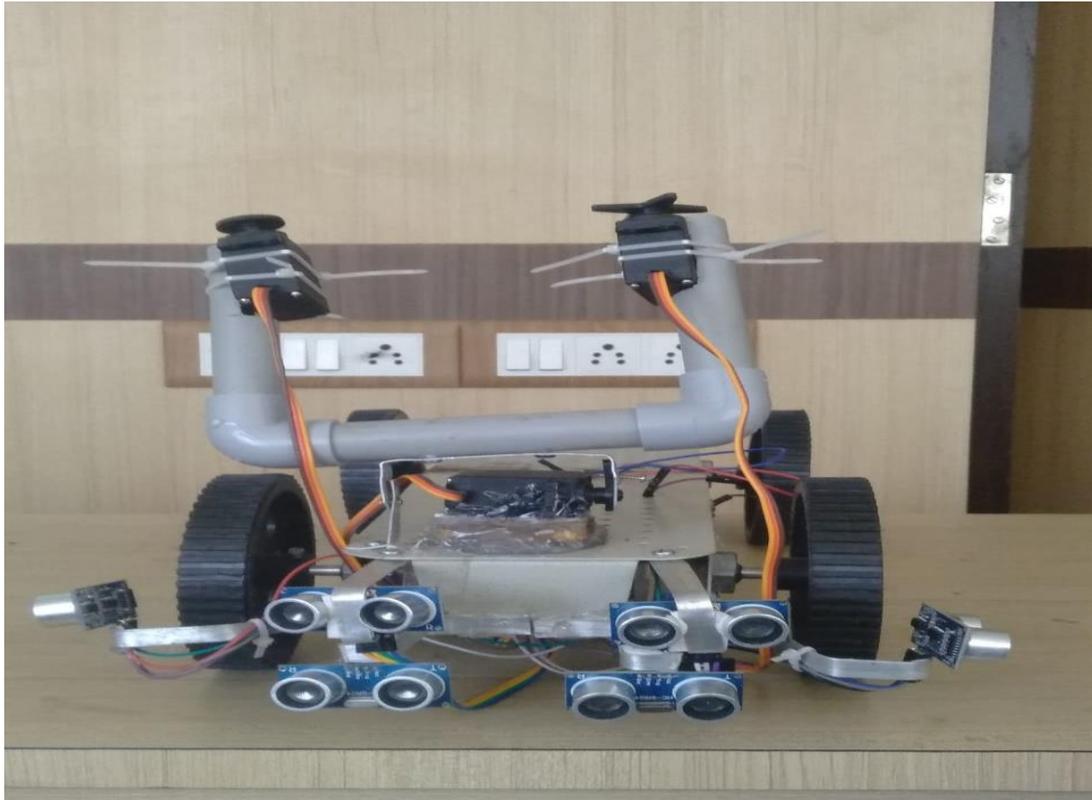
ER Diagram:



V. RESULTS

Software Results:



**Hardware Results:****VI. CONCLUSION AND FUTURE SCOPE**

System Endorse smart city infrastructure, using involvement of advanced technologies in the field of robotics, which is branch of Artificial Intelligence .Smart city infrastructure for upgrading itself needs to ease the quality and the standard of living for its citizens. These technologies have previously shown direct impact on in-house project hence , our system gives a new objective to integrate the outside world of smart city with the influence of robot, thus reducing human resource consumption overall cost and enhance the quality of smart city environment.

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