

## Smart City

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**Abstract-** In this research work we propose to create a prototype of smart city which will integrate street lights monitoring and control, garbage collection system and traffic monitoring system. *Street light:* The street lights will be automated for switching ON and switching OFF with some intelligence. The street light will be turn ON and turn OFF based on intensity of sunlight. The power consumed by the street light will be monitored and data will be sent to the cloud. The street light can also be controlled remotely using an android application. In case of any fault in a street light concerned authority will get the notification. *Smart garbage monitoring system:* Each garbage bin will be connected to cloud to sense the amount of garbage inside the bin. Whenever garbage crosses certain threshold level the concern authority will be notified so that garbage can be collected. Also a route map will be generated by the concerned to collect the garbage. *Smart traffic handling system:* There will be sensors to monitor the traffic density on every road and based on the traffic density the signaling system will be dynamically adjusted. Emergency green channel for ambulance can be created automatically by the systems. And all the data collected by the sensor will be sent to cloud for further data analysis. And based on the traffic pattern and with help of past data any abnormality in the city like riots, floods, or any other incidents can be detected and notified to the concern authority.

**Keywords-** Smart City, Smart bins, Smart Street light.

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### I. INTRODUCTION (HEADING 1)

In today's advance world there is need for smart things around us that can make our life comfortable, easy to live, so we proposed to make smart eco system which include adaptive traffic signals, smart garbage disposal bin & intelligent street lighting.

And with all the things connected to gather we intended to make better and much more efficient in terms of power consumption & clean city.

There is a smart garbage bin which senses the weight of the garbage & level of the garbage filled so the concern authorities will be notified automatically when the bin is about to filled.<sup>[1]</sup>

The street light will be intelligent enough to turn on & off automatically depending upon the sunlight intensity change i.e. summer/winter. It will enter into power saving when no traffic is there. It will sense traffic & turn on the lights temporarily.<sup>[2]</sup> So huge amount of energy is conserved. The light will also have on fault detection mechanism & will alert the authorities when there is a fault in street light. The adaptive traffic signals are on effective way of handling traffic.<sup>[3]</sup> Each traffic signal will analyses the density of vehicle on a particular road & adjusts the timing of red & green light of traffic signal. A green channel will be provided for ambulance the traffic data will be uploaded to the cloud to determine any emergency situation like riots, floods or natural colony based on traffic pattern.

### II. LITERATURE SURVEY

A new concept and a new theoretical account, which places on the new multiplication of information technologies, such as the internet of things, online cloud service, data analytics and space information integration, to facilitate the planning, construction, management and smart services of urban cores. Developing Smart Cities can benefit synchronized development, industrialization, informative, urbanization and agriculture. Modernization and sustainability of city's development.

The primary objective for emerging Smart Cities is to prosecute:

- Suitability of the public services;
- Delicacy of city management;
- Live ability of living environment;
- Smartness of infrastructures;
- Long-term effectiveness of web protection

Key components of Smart City are enlisted below:

- Smart Energy: Digital Management of Energy
- Smart Buildings: Automated Intelligent Buildings
- Smart Mobility: Intelligent Mobility
- Smart Technology: Seamless Connectivity

- Smart Infrastructure: Digital Management of Infrastructure
- Smarter Healthcare: Intelligent Healthcare Technology
- Smart Governance: Governance on-the-go
- Smart Citizen: Civic Digital Natives

Cities continuously evolve. First comes the phase of construction and development, followed by the overview of amenities that augmented people's lives. Then growth decelerates and new challenges arise, requiring cities to redefine and undergo a continuous cycle of renewal and restoration.

### III. METHODOLOGY

Basically work done is showcase by below block diagrams

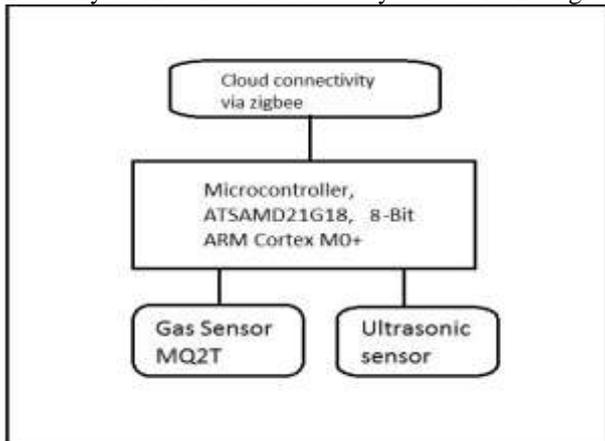


Fig.1 block diagram of Smart garbage monitoring system

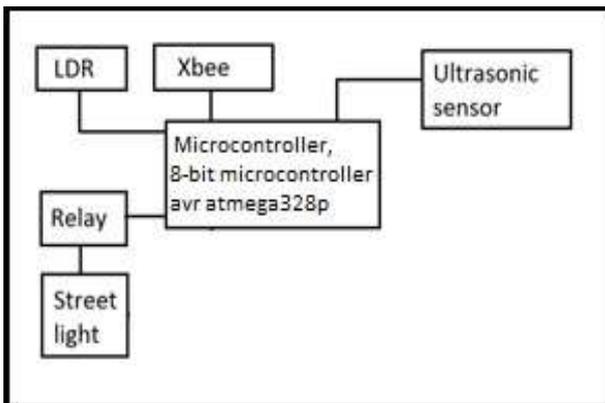


Fig.2 Block diagram of smart street lights

Here both the host MCU chosen are 8-bit AVR atmega328p, which is enough sufficient to handle the peripherals as per requirements. Let's enlighten garbage bin, as served from literature we come to know about stinking problem as municipality as well as commercial garbage bin always kept open which causes disease. To avoid that we attached gas sensor i.e. MQ2 gas sensor, which helps us as gas sensor module is useful for gas leakage detecting in home and industry. It can detect LPG, i-butane, propane, methane, alcohol, hydrogen and smoke. The MQ series of gas sensors use a small heater inside with an electro-chemical sensor. They are sensitive for a range of gasses and are used indoors at room temperature. The output is an analog signal and can be read with an analog input of the Arduino.

Sometimes due to low weight, some obstacle we kept in bin, which is low in size also, to detect that we used ultrasonic as well as load cell combination. Here load cell named as cantilever. Once bin is almost full ultrasonic sensor gives lower distance. Once distance is lower than 10 cm it'll indicate to Arduino which will redirect same information to Raspberry Pi.

For street light, if also as per the service we come to know about some problems as power saving mode. To provide the facility we turn on and off street lights as per the seasonal change as well as sun lighting effect. Although one more thing we attached here is to save power we can switch on alternate street lights specifically at a late night time when probability of traffic density is very less. For garbage level as well as stinking problem ZigBee is really helpful to do wireless communication between Arduino to Raspberry Pi. Here one more thing to mention is we kept Raspberry Pi as coordinator which is assisted by two router Arduino board interfaced with ZigBee.

### IV. EXPERIMENTAL WORK

The system consists of two modules which are smart garbage bin and Smart Street light. Deep down the garbage bin there are two sensors, ultrasonic distance measuring sensor and Gas sensor (MQ2) as easily as one microcontroller board (Arduino UNO).

The ultrasonic sensor is used to employ the altitude of the garbage level in the bin. The ultrasonic sensor is fixed at the top of the lid facing downwards, it measures the distance between the lid of the garbage bin and the garbage level. Lesser the distance more is the garbage inside the bin. The measuring range of the ultrasonic sensor is from 2 CM to 400 CM. The Gas sensor is used to check whether or not there is any decomposition or any harmful gases formed inside the bin. The garbage bin consists of wireless radio module (Xbee S2). The outdoor range of Xbee S2 module is approximately equal to 100 meters and works on 2.4GHz frequency. Once the distance reduces below a set threshold a flag is set. Also when high concentration of gas is formed another flag is set. The garbage bin sends data in the form of strings to the XBEE. Data is sent in an interval of every one minute. The string consists of latitude and longitude of the garbage bin, distance, distance flag, gas concentration level, and gas flag.

The XBEE sends data to the XBEE connected to the Raspberry Pi. The Raspberry Pi sends the data to the webpage using HTTP GET method. Google map API integration was done on the webpage. When the distance flag is set or gas flag is set, the location of the garbage bin is marked on the webpage.

The street light system consists of LDR, microcontroller board (Arduino UNO), relay and XBEE. The street lights can be controlled automatically by sensing the sunlight intensity by the LDR. Arduino has a built-in 10-bit Analog-to-digital converter (successive approximation) by which LDR can be easily interfaced to Arduino. Other than this the street lights can be controlled through the webpage. On the webpage we have created a drop-down menu to turn on or off particular street light, also an option to select power saving mode is provided which turns on alternate lights. On selecting the option a bit pattern is generated and is displayed on another webpage.

The raspberry pi gets the bit pattern from the webpage using the “urllib2” library for python. Using this library the raspberry pi is able to access the webpage and extract the bit pattern to control the street light. The same library is used to pass arguments (garbage bin parameters) to the PHP file through URL.

V. RESULTS

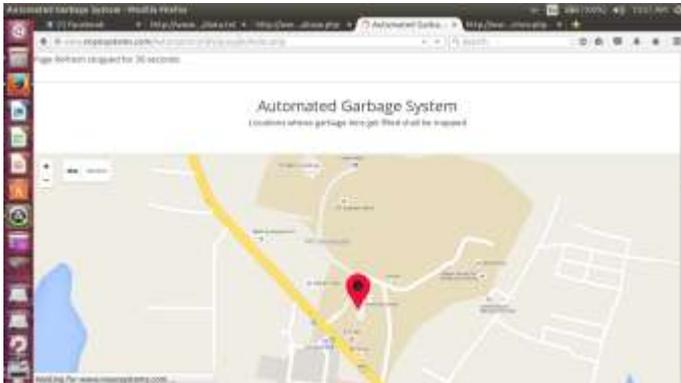


fig 3. Garbage bin located on Google map

Here as seen in fig 3. we try to locate each and every garbage on Google map by our cloud service, specifically for notification and monitoring purpose in bidirectional. So whenever ultrasonic will gives less distance, system automatically come to know that bin is almost nearer to full so on Google map red flag will be highlighted for the notification. So appropriate person will come and empty that particular bin. As well as all the time all bin will not be full. Some are frequently used, some are less used. By which we can do data analytics that which bin are more used to. Here internet of things part comes in the picture.

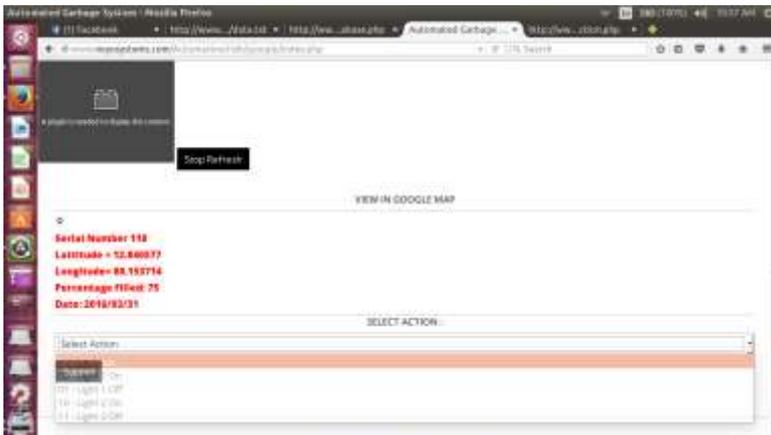


fig 4. Garbage bin data on cloud service

As illustrate in fig.4 each bin is service with static longitude and latitude. Here we took of our university. As well as for distinguish you may assign series number. The amount of [6]

garbage is full arrived in mm or cm, which is converted in percentage and showcase on cloud as seen above. Also flag status of garbage level and gas sensor is showcase for better and ease of graphical user interface.

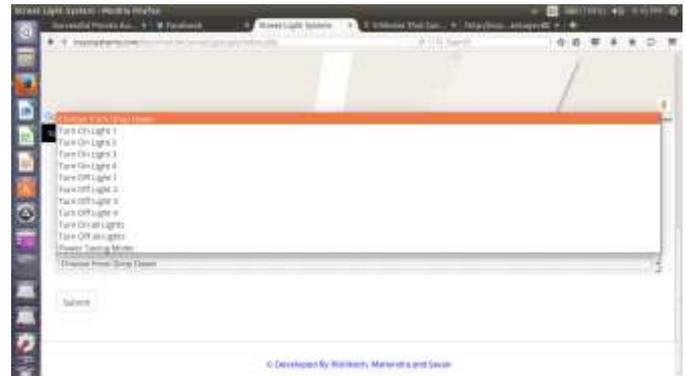


fig 5. Garbage bin located on Google map

As seen in above fig 5, here when you take multiple lights than provision of controlling is also essential. For demonstrative purpose 3 lights we took. We provide controlling option of each for turn on and turn off. Not enough, also power saving mode is also avail where specifically alternative lights would be turn on to save the power. It is generally used in late night time.

REFERENCES

We have successfully completed the following things:  
 Street Lights: Controlling the lights through internet.<sup>[1]</sup>  
 Smart Bin: Sending the Garbage level data and weight of the garbage to the cloud and plotting & notifying it in Google map.<sup>[4]</sup>

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