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Web Based Monitoring of Sensor Data for Smart Cities

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Abstract:
Internet of Things is the inter-connected network in which the physical devices, buildings and items embedded with software, electronics, sensors, actuators and other things. The goal of this project is to develop the Smart City model based on Internet of Things which provides the services like smart street lights, weather information which includes the temperature, humidity, air quality, air quality etc., traffic monitoring, waste management, smart parking, noise monitoring, water management and information system. Internet of Things provides the smarter way to handle these constraints remotely.

Keywords: Sensors and actuators, Communication hardware, interfaces and storage, sensor network, embedded hardware and software, embedded middleware.

I. INTRODUCTION

The Internet of Things is a recent communication methodology that visualize the near future in which the objects of day to day life will be equipped with sensors, microcontrollers, actuators, transceivers for digital communication and suitable protocols that enables system to connect with one another and with the users becoming a fundamental part of an internet. The IoT concept, hence, aim to making Internet making even more ubiquitous and pervasive. In addition, by enabling easy access and interaction with wide verity of devices such as, as an example of home appliances, monitoring sensors, surveillance cameras, actuators, displays, vehicles and so on. The IoT will provide development of number of applications that use for purpose of potentially extent amount and wide variety of data generated by such objects to provide new services to natives, companied and public administrative departments.

This methodology finds application in many different domains, such as industrial automation, home automation, hospitalization, mobile healthcare, smart energy and grid management, traffic management and much more. Smart City services such as waste management, noise monitoring, weather monitoring, parking issues, traffic monitoring etc. can be solved by using low-cost embedded hardware and software. To solve this purpose different types of sensors and actuators can be used. Once they are implemented then they are connected to IoT agent which handles or provides the IoT solution. They can provide continuous monitoring of sensor data and from that, some events and triggers will be made. It is also possible to visualize the data gathered from sensors in the form of graphs, values etc.

II. SMART CITY CONCEPT AND ITS SERVICES

Smart city is the region which includes the hi-tech infrastructure, real estates, communication strategies, market availability etc. Smart city also includes the public services such as waste management, traffic monitoring, weather monitoring, parking, noise monitoring, information systems, street lights etc. which defines the role of smart cities.

Waste Management: waste is an increasing and primary issue in urban cities, it must be handled very efficiently, for that intelligent waste containers must be developed so, they can sense the level of load and sends the signal to nearby waste collector trucks route so the cost needed for waste collection will be reduced hence, improved quality in recycling of waste.

Smart Street Lights: Street lights are installed in massive amount which consumes heavy usage of electricity power. To minimize the heavy usage of power it must be handled very efficiently for that LEDs can be used as they took small amount of power, furthermore light intensity can be reduced according to time of day and night when traffic is very less and as if vehicle is arriving then intensity of light can be increased, once vehicle is passed after certain amount of delay light intensity will be reduced. This will help to conserve less power by street lights.

Weather Information: Gives the weather forecast as well as live monitoring of weather such as temperature, humidity, air quality, amount of rain etc. in particular zones i.e. areas. So it will give an idea of weather for taking decisions.

Traffic Monitoring: As increasing in number of vehicles in cities, traffic monitoring plays the vital role to monitor the streets. It will provide the live footage of streets and gives the emergency alerts such as fire, accident etc. Surveillance cameras, image processing can be used to handle the situations.

Smart Parking: Due to increasing in number of vehicles issue like vehicle parking can be raised. Smart parking is the concept based on road sensors and intelligent displays which guides motorist to park the vehicle at empty slot. Some public parking shows the information about is parking empty or not. Maps can be used to find nearest parking with best past for park the vehicle. Also the IR sensors used to determine whether parking slot is empty or not.

Noise Monitoring: On the same line of weather information and traffic monitoring, a possible smart city service can be enabled to monitoring the noise pollution. Noise can be seen as a form of acoustic pollution as much as carbon dioxide seen

in air. As the local government issued the laws to control the noise pollution in cities at specific zones or in specific hours. Noise monitoring measures the amount of noise produced at specific time.

Information Systems: Information systems is the public information system which can be installed at specific zones. Information system gives the information of some live events, public messages etc. for better visualisation. It will be useful in some emergency situations.

III. ARCHITECTURE DESIGN

The overall logical architecture of the smart city framework is as shown in figure. It includes functional blocks well aligned with the IoT-A reference architecture specification and mainly addresses four different concerns:

(a) Enabling external applications to exploit functions and services offered by the platform (e.g., through cloud-based REST APIs);

(b) Enabling efficient handling of high-cardinality, high frequency event data, context data and metadata associated to managed entities (e.g., sensors);

(c) Mapping low-level data representations and communication paradigms into a common, shared and machine understandable set of models, and data-exchange paradigms, and, finally,

(d) Supporting effective communication inside and outside the platform. This high-level specification is materialized into a platform architecture organized around four layers

Following figure will describe the entire working architecture of sensors used in project:

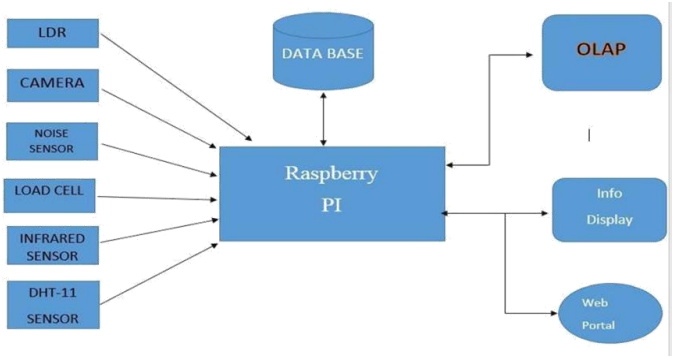

Fig 1: Overall architecture of System

A. *Interfacing of Sensors:*

1. Sensor interfacing for Smart Light:

LDR is having Sensing light conditions as day and night which is used for sensing the light. Also the IR Sensor pair is integrated for motion detection which in turns gives the service to control street lights for energy consumption. Following circuit is used for control the Street lights:

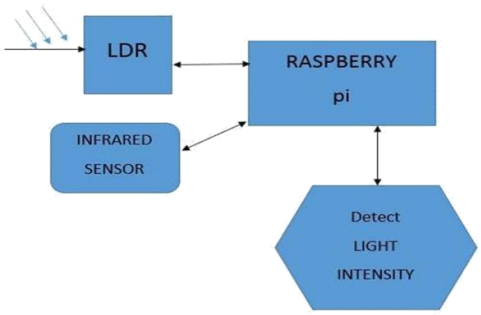

Fig.2 Sensor interfacing for Smart Light

2. Interfacing of temperature and humidity sensor:
For interfacing DHT-11 Sensor is selected, which measures temperature as well as humidity together. Selection of DHT-11 has following range for sensing the temperature and humidity in environment:

- Temperature-0-70 degree Celsius
- Humidity- 0-100 %
- Accuracy 3%

The output of sensor is single wired i.e. digital output. This is connected to port pin of Raspberry Pi and python programming is used to read the sensor data of temperature and humidity.

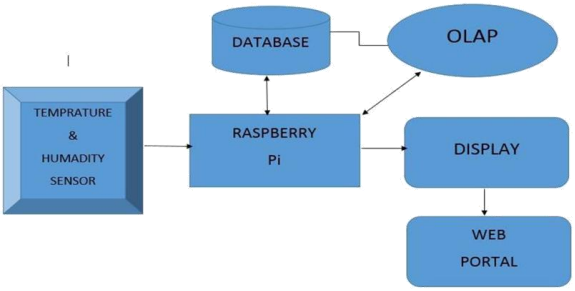

Fig.3 Interfacing of temperature and humidity Sensor

3. Interfacing of sensor for Traffic Monitoring:
Traffic monitoring and management is also important factor for smart cities. Camera is interfaced directly with Raspberry Pi for traffic monitoring. Following architecture is used for interfacing and handling the process:

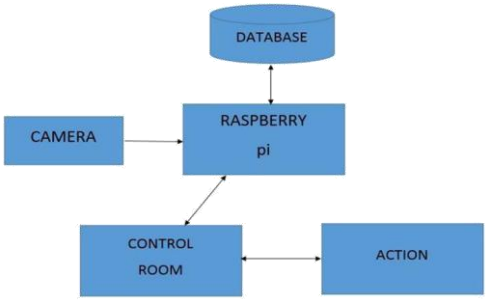

Fig.4 Interfacing of Camera for traffic monitoring

4. Interfacing of Noise Sensor

Noise sensor includes the microphone which measures the noise from various sources. And gives the output in decibels ranging from 0-99 Decibels. Microphone output is amplified and then used to indicate level in decibels. Output of this is connected to Raspberry Pi port pin or connected to adc mcp 3008. The digital output is then used to display the noise level in decibels. This information can then have transmitted to control room.

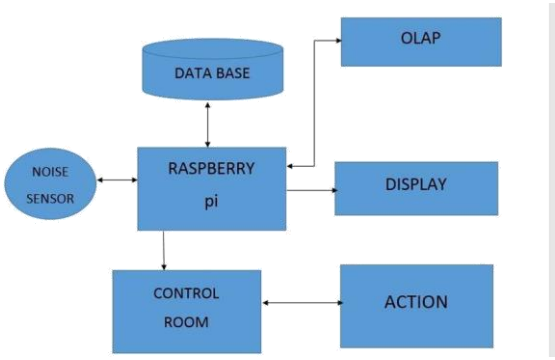

Fig.5 Interfacing of noise Sensor

5. Interfacing of Load Cell:

Load cell is used for detection of garbage in containers when garbage is filled the load cell o/p increases this is given to suitable signal conditioning circuit. This output is matched with set level. When garbage is full output is higher which sensed by Raspberry Pi which is then used to give signal and is send via internet to the waste management team. Output is given to mcp 3008 adc. This is connected to Raspberry Pi using pi interfacing.

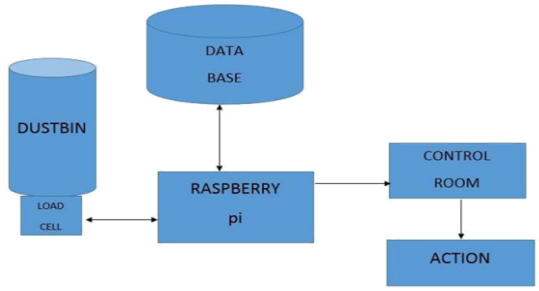

Fig 6: Interfacing of load cell

6. Interfacing of IR Pairs for Smart Parking:

For each parking slot IR transmitter receiver pair is used based on detector of car presence is sensed. If car is present output is '1' and If car is not present output is '0'. All parking slots together are measured and parking slots position is displayed at entrance.

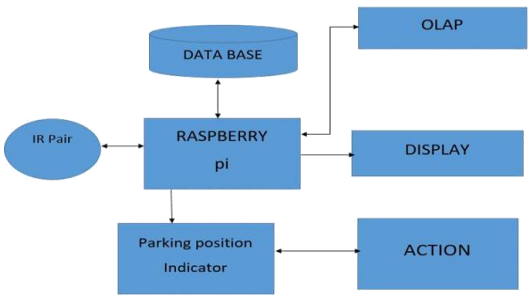

Fig 7: Interfacing of IR pairs for Smart Parking

B. Proposed model of Smart City Environment:

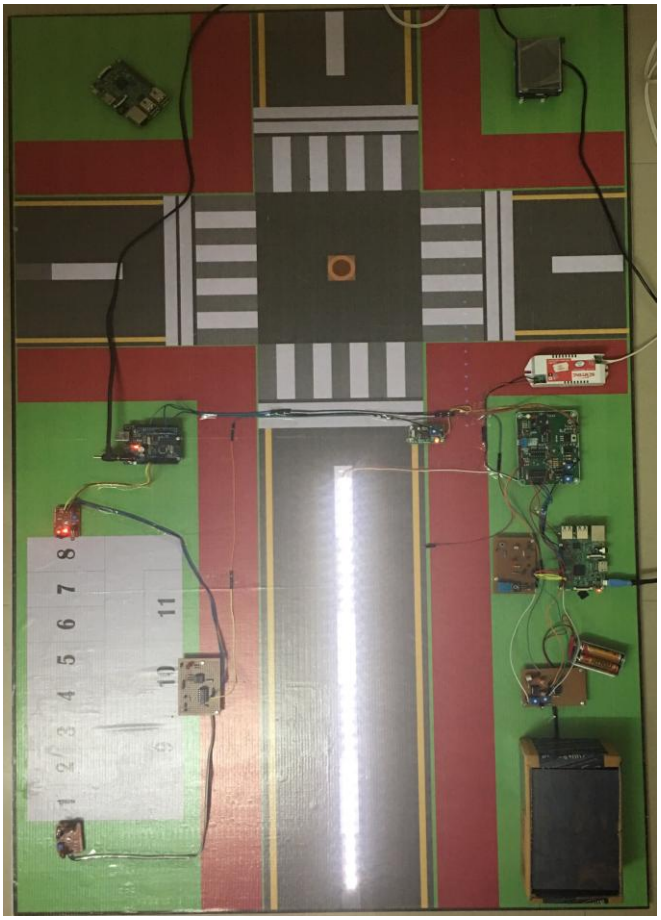

Fig 8: Proposed model of Smart City

IV. CONCLUSION

In this paper, we analyzed currently available working implementation of Smart City using IoT. The described technologies are approximate to being standardized and are already active in the production of equipment's that can take advantage of these technologies to run the applications with interest. In fact, while the array of designing patterns for Smart City systems are rather wide. The set of open and standardized rules i.e. protocol is smaller.

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VI. REFERENCES

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