Review Paper on Implementation of Smart City Prototype Using TensorFlow and Internet of Things.

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Abstract - As world urbanization continues to grow with the total population living in cities forecast to increase significantly, there is an increased demand for intelligent, sustainable environments that offer citizens a high quality of life. This is typically characterized as the evolution to Smart Cities. In this paper, we describe projects through which major systems of a city can be automated viz., waste management, street lighting and first response. The entire project is based on Raspberry pi, TensorFlow and Internet of Things. The waste is segregated based on type and data is collected and transmitted using LoRa modules to aid better waste management and recycling. The data thus collected is stored in a data base or cloud for analysis. Street lights are automated using a simple circuit Light Dependent Resistor Sensors and Infrared sensors. The street lights will turn on and off depending on atmospheric lighting conditions and if there in incoming traffic. The first response services like ambulance are streamlined by automated alerts in event of an accident. The project can be implemented on already available infrastructure and is easy to maintain thus reducing operation costs of a city while also making administration efficient and sustainable.

Key Words: *smart city, waste management, intelligent services.*

1.INTRODUCTION

Internet of things (IoT) is a communication paradigm that envisions a future where everyday life objects will be equipped with a microcontroller and some form of communication protocol.

One well-known product of IoT is the Smart City, which can be defined as a city with smart technology, smart people, and smart collaboration. IoT and Artificial Intelligence shall transparently and seamlessly incorporate a large number of heterogeneous end systems while providing open access to select subsets of data for the development of a plethora of digital services. One major topic within the smart city is smart waste management. When it comes to waste management systems, the communication distance between the waste collection center and the waste collection point is a major factor in determining the system's effectiveness. However, communication technology such as Bluetooth, Wi-Fi, and ZigBee offer better data transmission rates, but these are limited by their data transmission ranges. Conversely, available communication technology such as Lora and SigFox, which operate on a low power, wide-area network (LPWAN) are able to cater to the long-distance communication needed by the waste management system while sacrificing on the rate of data transmission. Studies in the field of wireless communication in IoT have also been accelerating.

To support Smart city vision, Urban IoT design plans exploit added value services for citizens as well as administration of the city with the most advanced communication technologies. To make emergency response real time, IoT enhances the way first responders and provides emergency managers with the necessary up-to-date information and communication to make use of those assets. Another very important aspect of a smart city is a street light system, in which lights on when needed and light-off when not needed. Currently, in the whole world, enormous electric energy is consumed by street lights, this is a huge waste of energy and should be changed. Our smart street light system consists of a LDR and motion sensors which will enable street lights to turn on when there is incoming traffic during the night and turn off during day time.

2. LITERATURE SURVEY

Teoh Ji Sheng et al[1] This paper presented a smart waste management system by implementing sensors to monitor the status of the bin, LoRa communication protocol for low power and long-range data transmission, and TensorFlow-based object detection to perform waste identification and classification. This automated segregation and monitoring system implementation in the bin aims to reduce the operating cost and improve the waste management system.

G Pavan Kumar et al[2] In this paper, the project has been designed by using an Arduino UNO board, LDR and IR sensor. Smart street lights are effective and extremely dependable. The two sensors, LDR (light dependent resistor) and a IR sensor, the role of these sensors in the project is to detects the intensity of atmospheric light and accordingly the street lights will switched on and also when detects an object coming towards the street light and it sends the message to the serially connected street lights through the cloud so that every street light in the particular serial will be automatically switched on.

Arsalan Khan et al[3] In this paper an accident detection and smart rescue system has been developed, which uses on board accelerometer sensor to detect accident and generate emergency alert and send it to the nearest emergency responder and will also send an SMS to emergency contact containing location coordinates of the accident. With real

time location tracking for both victim and responder the system will drastically increase the survival rate of an accident victim by providing emergency aid in time. The system will also provide help during other emergencies such as during fire, robberies/theft and other medical emergencies. Emergency responder will be able pin point victim's location on a Google map in real time.

Albert Meijer et al[4] This article brings some structure to the debate by analyzing a corpus of 51 publications and mapping their variation. The analysis shows that publications differ in their emphasis on (1) smart technology, smart people or smart collaboration as the defining features of smart cities, (2) a transformative or incremental perspective on changes in urban governance, (3) better outcomes or a more open process as the legitimacy claim for smart city governance.

3. PROPOSED SYSTEM

2.1 Methodology

The system will consist of 3 parts, a waste management module, an ambulance module and a smart street lighting module. The waste management module will be divided into 2 parts a receiver module and a transmitting module with a mechanical model of a segregation bin.

A simplified block diagram of all 3 modules has been illustrated below.

The transmitter module is entirely based on raspberry pi model 3B. Any waste dropped into the garbage collector will be detected by the Pi Camera and identified using the TensorFlow alogirthm already installed onto the Raspberry pi. The DC motor connected to a mechanical waste bin will be rotated to a degree based on the type of waste classified and will be segregated into the designated bin. On a larger scale the type of waste, and the amount of ech type of waste will also be monitored and stored into clound/database.

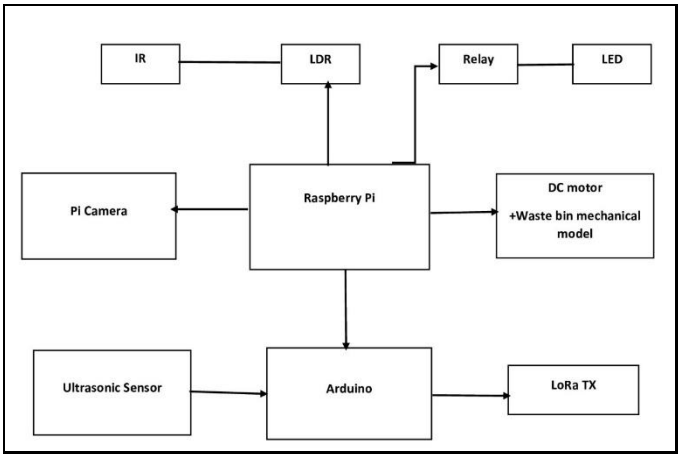

Figure 1: Transmitter and street lighting module.

The level of waste in the bin will be monitor using a ultrasonic sensor. All of the information collected will be the transmitted to the receiver end connected to cloud using LoRa modules.

The lighting module consists of a Light Dependent Resistor sensor and a Infrared Sensor. This will enable street lights to detect the atmospheric light conditions and turn on and off accordingly. Using IR sensor will make it so that the lights will only turn on when there is incoming traffic.

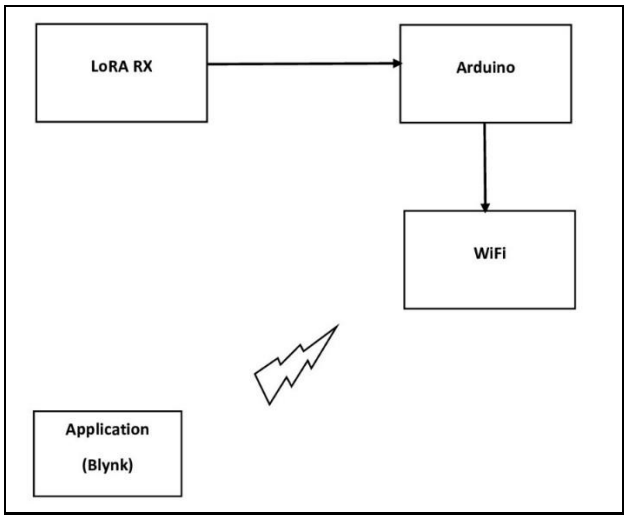

Figure 2 : Receiver Module.

The receiver module is simple constituting of a LoRa Reciever and a WiFi module to collect data. One receiver can receive data from upto 5 transmitters.

The Ambulance module makes use of a tilt sensor programmed at a threshold. At the event of a fall detection by the tilt sensor the GPS location and vehicle details will be sent to first responders via WiFi module.

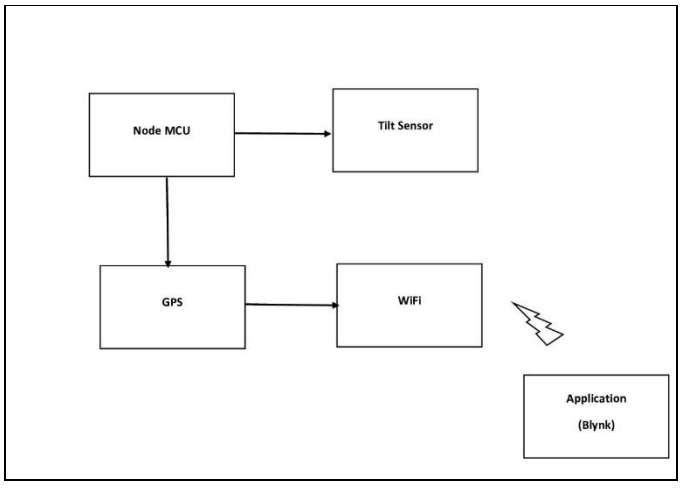

Figure 3: Ambulance Module.

3.2 Advantages

1. Makes use of pre-existing infrastructure and automates them.
2. Collection of waste data aids in better management and recycling of generated waste.Using Tensor flow

algorithm to detect the type of waste reduces the error margin significantly.

3. Using Lora one module saves significant amount of battery while also increasing transmission range.Passive yet systematic collection of data which creates room for additional improvements in management of waste.

3.2 Disadvantages

1. Accident detection modules will only work with vehicles equipped with the module.

4. CONCLUSIONS

This project presents 3 major aspects of a smart city viz., smart waste management system, street lighting system and an intelligent first response system. Currently available technology along with machine learning will be employed to develop the above mentioned systems.

Our proposed system gives primary importance to making use of available infrastructure to aid better management of an area or city.

A smart waste management system by implementing sensors to monitor the status of the bin, LoRa communication protocol for low power and long-range data transmission, and TensorFlow-based object detection to perform waste identification and classification. Smart street lighting system can save an enormous amount of electricity, this system also prevents the unnecessary wastage of electricity by the manual switching of the street lights. And the ambulance module aims at significant improvement in response time in case of accidents.

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