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A Smart Dustbin Using LoRa Technology

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ABSTRACT

This paper proposes a LoRa-based LPWAN vehicle to vehicle communication system for smart dustbin. The vehicle to vehicle communication system consists of a LoRa gateway, a remote diagnostic system, sensors for monitoring the garbage quantity and a cloud platform. The process is done by interfacing various modules such as GPS, camera, motors and sensors. When bin is filled with the garbage, then the sensors which keep track on the garbage level will sense the overflow of the bin. Once the sensor detects that the bin is full and needs to cleared it notifies. The LoRa gateway transmits the information about the garbage bin data to other nearby vehicle which is a smart dustbin by recording this information in the cloud platform. The smart dustbin which receives the information will move to the place of that bin for replacement. The dustbin can communicate with other dustbin. The dustbin can be controlled using LoRa technology and wide range of functions can be performed including braking by detecting the distance accurately. The smart dustbin is a carefully designed solution that solves the social issues of wastes disposal. This is a method in which waste management is automated.

Keywords: ***LoRa, LoRaWAN, Low power wide area networks (LPWAN).***

I. INTRODUCTION

Nowadays, people are facing many problems due to the improper disposal of waste. Due to improper disposal of waste soil, water, air pollution may occur. It becomes contaminated with hazardous materials. The chemical waste which is not properly disposed are absorbed by plants, that plants are consumed by the living organisms in future as the result it can lead to disease or even death. Waste disposal and recycling dealing with waste plays a major role for healthy environment. So a proper waste management system is most important.

This waste management system can be implemented using the vehicle diagnostic system development.

The wireless communication plays the pivot role for the communication in IoT. This is achieved by using WiFi, Bluetooth and cellular networks. However communication using these bands induces a paramount problems such as noise, interference, network lag, interruption and inefficiency. The proposed LoRa technology precludes these problems by having a separate networks. LoRa (Long Range) enables very-long range transmissions (more than 10km in rural areas) with low power consumption. Developing gateways between LoRa modules and cloud or

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transmitting medium. The main objective of this is to design a gateway for LoRa communication from vehicle to vehicle. Now a LoRa-based LPWAN vehicle to vehicle communication system for smart dustbin.

This system consists of LoRa gateway, a remote diagnostic system, sensor for monitoring the level of the garbage and a cloud platform. By interfacing various modules such as GPS, camera, motors and sensors. The various technologies like Bluetooth, WiFi, Zigbee is able to cover limited range of 10m-100m, 32m (indoor) and 95 (outdoor), 70-100m respectively. While LoRa is able to cover a range upto 20km with less power consumption and high capacity in terms of millions of messages per base station, ideal for public network operators serving many customers.

LoRa technology reduces cost in three ways namely infrastructure investment, operating expenses and end-node sensors. LoRa technology operates in the unlicensed ISM band which means no or very low spectrum costs. Any systems which are intended to provide fewer amounts of data over long range of several kilometers employ this LoRa technology.

LoRa is generally based on chirp spread spectrum modulation which uses linear wideband frequency modulated chirp pulses to encode the information. The architecture designed for LoRa technology incorporates the nodes and the gateways which communicate with network server.

LITERATURE SURVEY

LoRaWAN Device to device communication is established using the scheme based on LoRaWAN Mac command which uses two MAC command list such as Secure D2DReq, Secure D2DAns to enable security between nodes in Communication. The energy consumption in the proposed scheme increases by 4-5 % which has little effect on the lifetime of the end node.

Monitoring of Large-Area IoT sensors using a LoRa shows good performance for long range transmission in the country side. Design of LoRa wireless mesh network system for collecting data from IoT sensors distributed across a large geographical area. Wireless Mesh Network is a solution for increasing communication range and Packet Delivery Ratio without the need of additional gateways. LoRa Mesh Network achieved an average of 88.49% PDR whereas star topology achieved 58.7% under the same settings.

Low Power Wide Area networks are making fantastic progress from design, standardization and commercialization. The effects of interference has been investigated via single gateway with LPWAN technology. Unlike other wireless networks, LoRa employs an adaptive Chirp Spectrum modulation scheme. This extends the communication range in the absence of any interference.

Power consumption and LoRa range and specifications are studied. Tracking monitoring system, node to node communication was studied.

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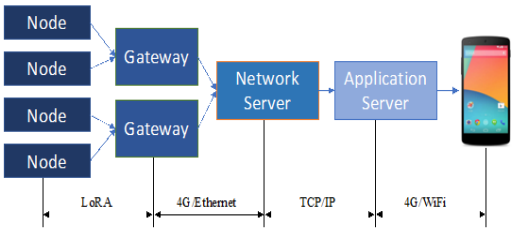
EXISTING BLOCK DIAGRAM



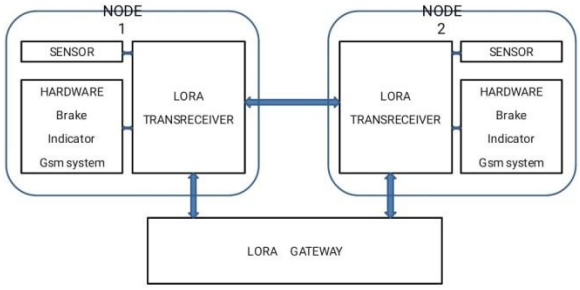
The basic block diagram of LoRa consists of end nodes, gateway, network server, application server. End-nodes transmit directly to all gateways within the range using LoRa. The end-node are LoRa embedded sensors. The nodes typically have sensors, LoRa transponder and a micro-controller. Sensors are used to detect the changing parameters like temperature, humidity, GPS.

LoRa transponder to transmit signals over LoRa patented radio transmission method. Optionally a micro-controller (with on memory). Gateway, the LoRa sensors transmit data to the LoRa gateways. The LoRa gateways can be connected to the internet through the standard Internet protocol and then the data received from the LoRa embedded sensors to the internet is transmitted i.e. a network, server or cloud. The gateways devices are always connected to power source. The gateways acts as a transparent bridge when connected to the network server through standard internet protocol connections, simply converting RF packets to Internet protocol packets and vice versa.

The network server connects to the gateways and de-duplicates data packets and then routes it to the relevant applications. The network server scan be used for both uplink (i.e. sensor to application) or downlink (i.e. application to sensor) communication. In application server, the network server forwards received uplink frames and acknowledgements to application server.

It can be any LoRa application server or any application server developed on our own. The LoRa MOTE module comprises of 14 general purpose input output pins. These pins are restricted to sink and source capabilities. The communication section is designed with transceiver module such as RN2483 which is a module based on 434 MHz, 868 MHz frequency range. The long range spread spectrum communication with high interference immunity is provided by the RN2483 transceiver module features LoRa technology Radio Frequency modulation.

PROPOSED SYSTEM



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A LoRa-based LPWAN vehicle to vehicle communication system for smart dustbin. The vehicle to vehicle communication system consists of a LoRa gateway, a remote diagnostic system, sensors for monitoring the garbage quantity and a cloud platform. The process is done by interfacing various modules such as GPS, camera, motors and sensors. Military Ad-Hoc networks and people network vehicular delay tolerant network (VDTN) architecture has been proposed to deal with challenging vehicular communication scenarios. Based on principles of asynchronous and bundle oriented communication from the DTN architecture. The design of the VDTN network architecture and its protocols, present unique characteristic and its protocols, present unique characteristics, Internet protocol over VDTN approach incoming packets are aggregated in large data packets called bundles. Out of band signaling (with control and data planes separation). The designing process is done by interfacing various modules such as GPS, camera, motors and sensors.

A vehicle which is a smart dustbin consists of sensor which keep track on the garbage level in the dustbin .Once the sensor detects that the bin is full and needs to be cleared it notifies and send the information to the other near by smart dustbin. So that after receiving the information this vehicle will move to that area for replacement. Thus the vehicle can communicate with another vehicle. The dustbin can be controlled using LoRa technology and wide range of functions can be performed including braking by detecting the distance accurately.

RESULT

The implementation of the smart dustbin by using LoRa technology. The vehicle to vehicle communication system concept is involved. Finally a smart dustbin using LoRa technology is executed.

CONCLUSION

The smart dustbin is a carefully designed solution that solves the social issues of wastes disposal. This is a method in which waste management is automated. This mainly concentrates on producing a gateway design for the LoRa network. The LoRa gateway transmits the information about the garbage bin data to other nearby vehicle which is a smart dustbin by recording this information in the cloud platform. The smart dustbin which receives the information will move to the place of that bin for replacement. The dustbin can communicate with other dustbin.

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