SMART CITY SYSTEM

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Abstract - This paper focuses on three different modules that will help to make city smart using IoT. First module will work as a smart dustbin. Second module will work as a smart street light and Third module will work as a Smart traffic control system. An increase in Human population possesses a huge challenge to garbage management. Our project aims to find a solution by using a Smart dustbin. A normal dustbin that mounted technology equipment's which consist of sensor technology, GPS technology and other more. Smart dustbin constantly checks current garbage level. When the maximum garbage level is reached the smart dustbin will notify the department to collect the waste through call or messaging. The second module that is the Smart street light provides a solution for energy saving which is achieved by sensing an approaching vehicle and then switching ON a block of street lights ahead of the vehicle. As the vehicle passes by, the trailing lights switch OFF automatically. Thus, we save a lot of energy. And when there are no vehicles on the highway, then only some of lights will be ON. Traffic congestion is a major problem; bad traffic management has led to traffic congestion. The third module is smart traffic control system in which traffic is detected by the sensors Connected in Every square. The Traffic Jam of Next Square will be indicated by blinking the RED led of traffic light in Previous square. And same time traffic will be sending to the cloud using IoT. Also traffic congestion and traffic jams are the major hurdles for emergency vehicles such as ambulance carrying critical patients as these emergency vehicles are not able to reach their destination in time. This problem can be solved to some extent with "Smart Traffic Control System for ambulance". The proposed system clears the traffic congestion by turning all the red lights to green on the path of the ambulance using the IoT cloud.

Key words: IoT, Smart Dustbin, waste management, Smart street light, energy saving, traffic management.

1. INTRODUCTION

The rapid growth in population leads to more waste disposal and the Garbage overflow is the main issue which creates unhygienic condition.

This leads in spreading some deadly diseases and human illness. To avoid such conditions we are going to implement a module in a smart city project called IoT based smart dustbin. The smart dustbin monitors the status of it and accordingly takes the decision. These Smart dustbins are connected to the internet to get the real time information. These dustbins are interfaced with NodeMcu with Ultrasonic Sensors placed on the lid of the dustbin. The Ultrasonic sensor detects the level of the waste in dustbin and sends the signals to NodeMcu which then send on the cloud and according to status of dustbin it receive by the receiver that is the garbage collector. Currently a large amount of electric energy is consumed by the street light and this causes energy wastage when not needed. The vehicles are passing over always but some part of places consisting of less density area and even no vehicle movement is in few areas. During night all street lights are ON in conventional street lighting system which leads energy wastage. To overcome from these issue, a proper energy saving method is to be implemented which is Smart Street Light System. This project is to save energy by detecting a vehicle moving towards the street and turn ON a block of street lamps in front of the vehicle. As the vehicle moves forward the lamps will turns OFF on its own. So each of the light stays in off condition when there are no vehicles on the street. The rapid growth of the population increases the number of vehicles on roads and also increases the traffic jams. Traffic jams just not waste time but criminal activities like mobile snatching at traffic signals also happen. Also it affects ecosystem badly. A smart traffic management system is an easy way to improve this. The concept of the Internet of Thing (IoT) has been introduced in traffic management systems. For better traffic management the detection of traffic jam should be done before heading to that signal. So in Smart traffic management system traffic jams will be detected early on the previous signal. This can be achieve by using IR sensors, the sensors will be placed at some distance on the road which will detect the traffic if the sensor gets signal then they will send those signal to the Node Mcu. This will results in blinking of the LED of the traffic light of the previous signal. In this case the person will acknowledge that there is a jam ahead, which will help him taking the other route if possible. An increased in vehicles not only increases the time of emergency vehicles, but also increases the chances for them being involved in accidents. The emergency vehicle at a high speed on a red light poses danger to traffic on other roads and can cause accidents. To solve this problem we proposed a system which involves a traffic clearance for Ambulances. The route of the ambulance will made green zone so it can pass without any hurdle and can reach its destination in time.

2. METHODOLOGY

The complete project has been divided in three different modules; first module will work as a smart dustbin. Second module will work as a smart street light and Third module will work as a Smart traffic control system In First Module ultrasonic sensors are being used to monitor the amount of waste in dustbin, the real time data from ultrasonic sensors are sent to cloud over IoT. To send data over IoT, we have used NodeMcu (ESP8266 12) module. It will be collecting data from ultrasonic sensors and it will send to the iot platform. In Second module we have used IR sensors to detect vehicle in front of traffic light, this IR sensors are connected to the another nodemcu. As soon as the vehicle will be detected by the IR Sensors, the particular street light near to the vehicle will be turned ON for 5 second. In Third module we have used 89C51 Microcontroller to control the Traffic lights, and this 89C51 microcontroller communicated with 2nd Nodemcu via serially through TX and Rx pins. The Traffic is detected by the IR sensors Connected in Every square; The Traffic Jam of Next Square will be indicated by blinking the RED led of traffic light in Previous square. And same time traffic will be sending to the cloud using IoT. The programming of NodeMcu (ESP8266 12) will be done through Arduino IDE. For IoT connection Internet connectivity is provided through Wi-Fi to send data to IoT Platform. The UBIDOTs IoT platform is used to monitor the parameters of smart city such as amount of waste in all areas dustbin at time and traffic in different areas in city. This cloud is user friendly and easy to design for any IoT application. The programming of 89c51 microcontroller will be done through Keil software and used embedded or Assembly language to programming. Complete system layout has been shown in figure 1.

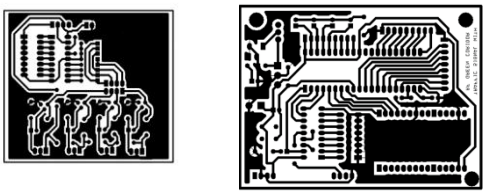

Fig. 1: Implemented system layout

3. HARDWARE AND SOTWARE DETAILS

1. Details of hardware components used-

a. NODE-MCU: It is a low-cost open source IoT platform. It initially included firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which was based on the ESP-12 module. ESP8266 module is a low cost standalone wireless transceiver that can be used for end-point IoT developments.

Fig. 2: NodeMCU

b. 8051: 8051 is an 8 – bit Microcontroller i.e. the data bus of the 8051 Microcontroller (both internal and external).It is 8 – bit wide and has a CISC based Microcontroller with Harvard Architecture (separate program and data memory).

Fig.3: 8051 Microcontroller Architecture

c. ULTRASONIC SENSOR: Ultrasonic transducers or ultrasonic sensors are a type of acoustic sensor divided into three broad categories: transmitters, receivers and transceivers. Transmitters convert electrical signals into ultrasound, receivers convert ultrasound into electrical signals, and transceivers can both transmit and receive ultrasound.

Fig .4: Ultrasonic Sensors

d. INFRARED SENSOR: It is an electronic device that detects and measures infrared radiation in its surrounding environment. There are two types of infrared sensors: active and passive. Active infrared sensors both detect and emit infrared radiation. Active IR sensors have two parts: a light emitting diode and a receiver. When an object comes close to the sensor, the infrared light from the LED reflects off of the object and is detected by the receiver. Active IR sensors act as proximity sensors, and they are commonly used in obstacle detection systems. Passive infrared sensors only detect infrared radiation and do not emit it from a LED.PIR sensors are most commonly used in motion-based detection, such as in-home security systems.

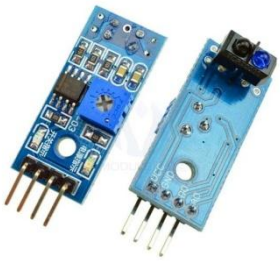

Fig. 5: INFRARED SENSOR

Following is the complete functional block diagram for implemented system in figure6.

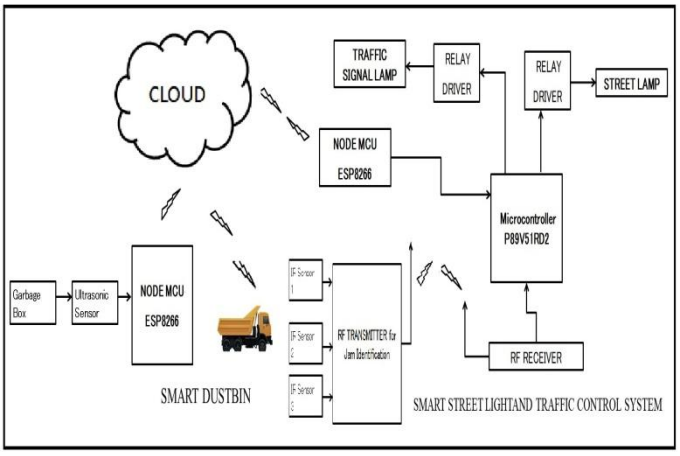

Fig. 6: System block diagram

e. RF MODULE: The RF module operates at Radio Frequency. The corresponding frequency range varies between 30 kHz & 300 GHz. In this RF system, the digital data is represented as variations in the amplitude of carrier wave. This kind of modulation is known as Amplitude Shift Keying (ASK).

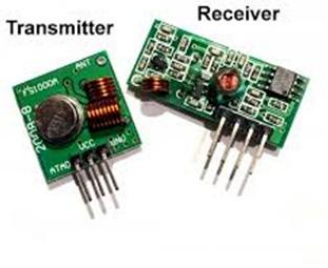

Fig. 7: RF Transmitter & Receiver

f. HT12 ENCODER & DECODER: HT12E is an encoder integrated circuit of 2^12series of encoders. They are paired with 2^12series of decoders for use in remote control system applications. It is mainly used in interfacing RF and infrared circuits. The chosen pair of encoder/decoder should have same number of addresses and data format.HT12D IC is a decoder integrated circuit that belongs to 2^12series of decoders. This series of decoders are mainly used for remote control system applications, like burglar alarm, car door controller, security system etc. It is mainly provided to interface RF and infrared circuits. They are paired with 2^12series of encoders.

Fig. 8: HT12 ENCODER & DECODER

2. Software details:

Internet of Things: The Internet of Things (IoT) is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. The definition of the Internet of things has evolved due to the convergence of multiple technologies, real-time analytics, machine learning, commodity sensors, and embedded systems. Traditional fields of embedded systems, wireless sensor networks, control systems, automation (including home and building automation), and others all contribute to enabling the Internet of Things.

Fig. 9: Internet of Things

Ubidots: Ubidots is an IoT Platform empowering innovators and industries to prototype and scale IoT projects to production. Use the Ubidots platform to send data to the cloud from any Internet-enabled device. You can then configure actions and alerts based on your real-time data and unlock the value of your data through visual tools. Ubidots offers a REST API that allows you to read and write data to the resources available: data sources, variables, values, events and insights. The API supports both HTTP and HTTPS and an API Key is required**.** Data will be protected with two more replication, encrypted storage and optional TLS/SSL data support. You can also customize permission groups to each module of the platform, making sure the right information is shown to the right user.

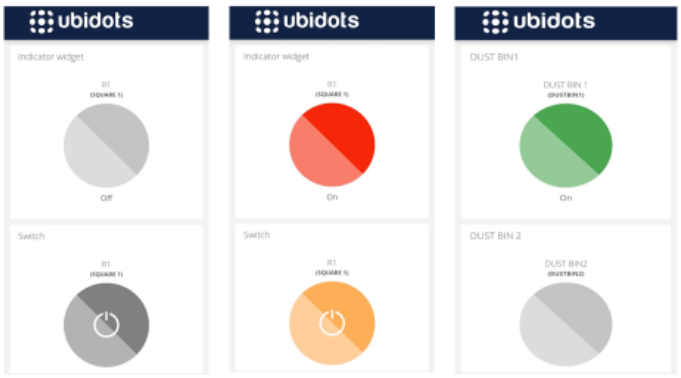

Fig.9: Ubidots Dashboard

4. RESULT

The system had been implemented successfully. It is completely automatic system which can perform three different tasks in one unit monitoring, distribution, analysis of water quality and storing energy. User can also save water, save money. Time to time alert has been given on water utilization.

5. CONCLUSIONS

This project is useful for everyone, as a result in a new concept of Smart street light system, the energy saving take place Also, the system maintenance cost is reduced because the LED has more life than previous lights. The new system of IR sensor is beneficial for avoiding the accidents and better traffic management.The Smart Dustbin system help to monitoring of domestic wastage clearance at proper time to avoid damage to the public health. A web server is also been set up through which the authorities also get information about the bins in their area. It uses sensors for sensing information of Bins and sending to workstation, which is situated at municipal office for finding shortest path. The proposed system is an attempt to improve current waste collection system in India.So the “Smart City System" is better solution for traffic management, energy saving and garbage management which is purely based on digital platform like IOT, Ubidots. We can also used hardware components like Node-MCU, 8051Microcontroller, IR Sensor, Ultrasonic Sensor, RF Module, HT12 Encoder and Decoder. The System made with affordable cost.

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