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Smart GIL System using IoT

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***Abstract*: The project aims to make a smart GIL system for smart cities. Smart cities face the challenges of energy consumption, waste management and water conservation. The function of garbage collection system, smart irrigation system and smart street lighting system are integrated into a single system namely smart GIL system and controlled by a single controller. The performance of these system can be monitored in a common control room. The data can also be monitored in the mobile phone by using IoT. The system reduces the man power and act smart in maintaining smart cities. Garbage collection system indicates the availability level of the dustbin. Irrigation system is used for watering the plants by measuring the moisture content in the soil. Lighting system is used for the automation of the street lights during night time. Availability level of dustbin, motor ON/OFF state of irrigation system and light ON/OFF state with day/night indication will be displayed in a common control room. These data are transferred to cloud server through serial communication and can be viewed in a mobile application.**

***Keywords*: GIL, Garbage, Irrigation, Lighting, IoT.**

1. Introduction

In present day, people are facing lot of problems in waste, water and energy management. Due to increase in population of India, it leads to increase in waste also. India faces major environmental challenges associated with inadequate waste conservation. In current scenario more wastes are generated in urban area and these waste are not collected at the proper time, this leads to overflow of garbage in the road side. It creates an impact on environment and public health. GIL system automatically detects the availability level of bin and is indicated in the control room. Automation of the irrigation system for social welfare to provide adequate irrigation and to conserve water if the plant is irrigated in the required area is also taken care by the GIL system. Lighting can account for 10-38% of the total energy bill in typical cities. The idea of designing new system for street light that do not consume huge amount of electricity became a part of GIL system. Manual control will cause an error and leads to energy waste and manually dimming during midnight is impracticable, but this is made possible by using sensor. The project focuses on integrating these three management system with help of embedded system interfaced with IoT.

2. Literature review

Shobana G, Sureshkumar R published a paper under "Automated Garbage Collection using GPS and GSM" in International Journal of Pure and Applied Mathematics, 2018.This method is advanced in which sensor based automation system developed to automate the detection of bin level. The level of garbage bin can be measured by means of ultrasonic sensor. Garbage system is interfaced with microcontroller. The processor process the data and send it to the cloud and display the level using user interface like webpage and app.

Isha Abdulazez Watson, Oshomah Abdulai Braimah, Alexander Omoregie published a paper under "Design and Implementaion of an Automatic Street Light Control System" in International Journal of Emerging Technology and Advanced Engineering, 2015. In this paper two kinds of sensors are used which are light sensor and photoelectric sensor. The light sensor will detect darkness to activate the ON/OFF switch. The photoelectric sensor will detect the movement to activate the street lights. These are controlled by microcontroller.

Abishek Kumar, Magesh.S a paper under "Automatic Irrigation System based on Soil Moisture using Arduino" in International Journal of Pure and Applied mathematics,2017. In this paper soil sensor is connected to Arduino board which senses the moisture content present in the soil. Whenever the moisture level goes down, the sensor senses the humidity change, giving signal to the microcontroller so that the pump is activated.

3. Proposed system

Arduino ATmega328 is used as a microcontroller. Analog signal from the IR sensor is given to the controller based on the signal output from the sensor LED is turned ON/OFF. If an object is detected by IR sensor, then the LED will be turned ON for certain time delay. LDR sensor will give the output as day or night based upon the amount of light falling on is surface. Ultrasonic sensor will measure the distance available in the dustbin. It will provide the availability value of bin as digital input to the controller. Moisture sensor will measure the moisture content of the soil where it is placed and gives high signal to the controller when moisture content is low which will send an high signal to the motor drive circuit to turn ON the

motor. Motor will be turned OFF if the moisture content is high. Temperature sensor is used to measure the temperature of the surroundings. The data regarding motor ON/OFF state, light ON/OFF state, availability level of bin and the temperature is displayed in the LCD display. These data are viewed in the mobile application by sending those data to the cloud server through the Wi-Fi module. The data transfer takes place by means of serial communication from the Wi-Fi module to the cloud server.

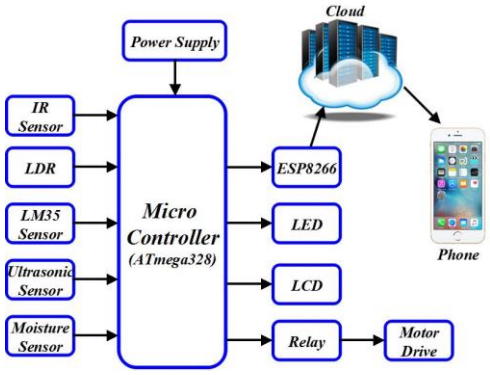

Fig. 1. Block Diagram

4. Hardware description

A. Arduino Uno

Arduino Uno ATmega328P microcontroller is used as a heart of the project. It is programmed in embedded c language. It contains digital pins, analog pins, reset button, etc. It is commonly used in most of the autonomous system because simple to use, low power requirement.

B. IR sensor

IR sensor is used to detect the motion of the object by measuring the heat of the object. It will not emit any type of IR radiation rather than measuring it hence it is also called as a passive IR sensor. IR sensor is a device which basically consists of a photo-coupler or an opto-coupler that is it contains a pair of an IR LED. The IR LED emits IR radiation, intensity of reception of which by the photodiode dictates the output of the sensor.

Fig. 2. IR Sensor

C. Ultrasonic sensor

An Ultrasonic sensor is a device that uses sound waves for measuring the distance between the objects. The sound waves are send at a specific frequency and waiting for the sound wave to bounce back, the time taken is used by the device to measure the distance. By recording the time taken between the sound wave that is send and the sound wave received, it is possible to calculate the distance between the sensor and the object.

Fig. 3. Ultrasonic Sensor

When a high voltage electrical pulse is applied to the ultrasonic transducer it starts vibrating across a specific spectrum of frequencies and generates a sound waves. Whenever the obstacle comes, then the sound waves from the ultrasonic sensor will generate an electric pulse by reflecting back in the form of echo. It calculates the time taken between sending sound waves and receiving sound waves. The signal's condition can be found by comparing the echo patterns with the patterns of sound waves to determine detected signal's condition.

D. Temperature sensor

Temperature sensor is a device that is used to measure the amount of heat or cold energy that is generated by an object or system, the analog or digital output will be produced by the sensor to indicate the physical change in the temperature.

E. Soil moisture sensor

Soil moisture sensor measures the volumetric content in the soil. Since the measurement of free soil moisture requires removing, drying and weighing of a sample. It may be varied depending on environment factors such as soil type, temperature or electrical conductivity.

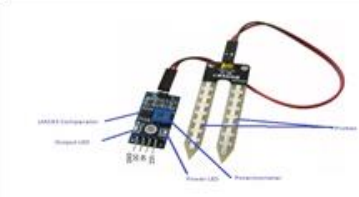

Fig. 4. Soil moisture sensor

F. ESP8266 module

The ESP8266 Module is used as a Wi-Fi module which has a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to the Wi-Fi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware, simply hook this up to your Arduino device and get about as much Wi-Fi ability. It is a low-cost Wi-Fi microchip, with a full TCP/IP stack and microcontroller capability.

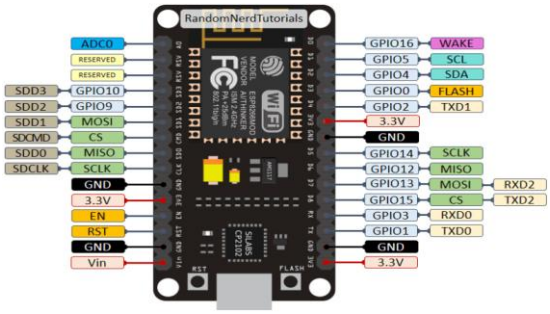

Fig. 5. Wi-Fi module

G. *LCD display*

A Liquid Crystal Display is a display unit built using Liquid Crystal technology commonly abbreviated as LCD. 7 Segment display is the most basic form of electronic display available and it has its own limitations. 16×2 LCD Module is the most commonly used one, which can display 32 ASCII characters in 2 lines.

H. *Submersible pump*

A pump is a device that moves the water or some fluids by performing some mechanical actions, which has a motor coupled to the pump body. It is used in the motor driver circuit for the irrigation purpose. The whole setup is submerged in the water to be pumped. It works by converting a rotational energy from the motor to induce the flow of raising water pressure.

Fig. 6. Submersible pump

5. Result

The data about the light and motor state, availability level of the dustbin and the temperature is displayed in the LCD display.

Fig. 7. Hardware output

6. Conclusion

The smart GIL system using IoT for smart cities is cost effective, practical, eco-friendly and the safest way to reduce the wastage of water, reduces the environmental impacts created by the disposal of waste on road sides and also reduces the wastage of electricity. With the good resource planning and advances in technology the cost of the project can be reduced and also with the use of good equipment the maintenance can also be reduced in terms of periodic checks.

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