

IOT Based Model of a Smart Village

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ABSTRACT-Village equipped with all the modern technology without destroying the nature can be defined as smart village. The number of villages where proper and immediate care is not taken against abnormalities like garbage overflow, water supply problems, checking quality of water, the digital display of government offers and subsidies and also against electrical issues like street light monitoring. Using the proposed system, the problems can be solved. The proposed system also aims at internet of Things (IOT) is a recent communication paradigm that envisions a near future, in which the objects of everyday life will be equipped with microcontrollers, transceivers for digital communication, and suitable protocol stacks that will make them able to communicate with one another and with the users, becoming an integral part of the Internet.

Keywords: Smart village, IOT, Modern village.

Introduction

Village equipped with all the modern technology without destroying the nature can be defined as smart village. The system consists of centralized microprocessor interfaced with many sensors for making the villages cleaner and smarter. The system aims to bring smartness in four different aspects of any village such as digital display of the government subsidies and offers to farmers, smart garbage management, intensity based street light monitoring and digital water supply system. The internet of things (IOT) is recent communication paradigm that envisions a near future in which the objects of everyday life will be equipped with micro-processor, transceivers for digital communication, and suitable protocol stacks that will make them able to communicate with one another and with the users, becoming an integral part of the internet. The IOT concept, hence, aims at making the internet even more immersive and pervasive.

BLOOCK DIAGRAM AND DESCRIPTION

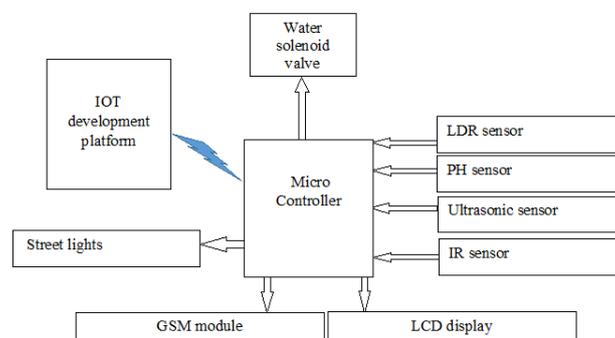


Figure 1: Block diagram of the IOT based model of a smart village

System Description

The block diagram Figure 1 depicts a basic system implementation of the proposed system. The microcontroller ATMEGA 328P is the heart of the proposed system. All the sensors are connected to the microcontroller. The project aims to bring smartness in four different aspects of any village such as digital display of the government

offers and subsidies to farmers, smart garbage management, Intensity based street light monitoring and digital water supply system.

The Ultrasonic sensor, pH sensor, IR sensor, LDR and Relay and Solenoid valve are connected to the microcontroller. The ultrasonic sensor used to measure the level of garbage, LDR is used to control the automatic ON and OFF of the street light, pH sensor is used to measure the quality of the water, solenoid valve is used to control the flow of water.

The output part consists of 16×2 LCD display and auto street light monitoring system. 16×2 LCD is used to display the government offer and schemes, also display quality and range of water. Garbage level is detected using ultrasonic sensor, when it reaches maximum level, through global system for mobile communication (GSM) messages are sent to higher authority. Using LDR street lights are controlled automatically.

The Arduino is a small, complete, and breadboard-friendly board based on the AT mega328p. It has 14 digital pins and 8 analog pins. The operating voltage is 5 volts. It lacks only a DC power jack, and works with a Mini-B USB cable instead of a standard one. Ultrasonic sensor is used to measure the distance of the object. It ranges from 2cm-4m, operating frequency is 40 kHz. It has two pins echo and trigger. Echo acts as a transmitter and trigger acts as a receiver. The ESP8266 is a Wi-Fi chip with full of TCP/IP stack and MCU. ESP8266 requires 3.3V power supply. It is capable of either hosting an application or offloading all networking functions from another application processor. A liquid-crystal display, it is a 16×2 display. A 16×2 LCD means 16 character per line and there are two such lines. It is used to display the ASCII values of a character to be displayed on the LCD. A Solenoid valve is an electromechanically operated valve. Used to control the flow of water. It requires 24 V. A pH meter is a scientific instrument that measures the hydrogen ion activity in water based solutions, indicating its acidity or alkalinity expressed as pH. It is used to measure the quality of water, its ranges from 0 to 14. pH range is above 7 are acidic water, pH range is below 7 are basic water, pH range is 7 are normal water. LDR Sensor is used to detect the presence or absence of light. The resistance of a LDR decreases with increasing incident light intensity, resistance is several mega ohms. The resistance of the LDR increases with decreasing incident light intensity, resistance is few hundred ohms. The IR Sensor mainly consists of the IR transmitter and receiver, Op-amp, variable resistor, output LED. When an object is detected within the range of the IR sensor LED glows. Used for automatic control of railway gates.

IMPLEMENTATION AND DISCUSSION

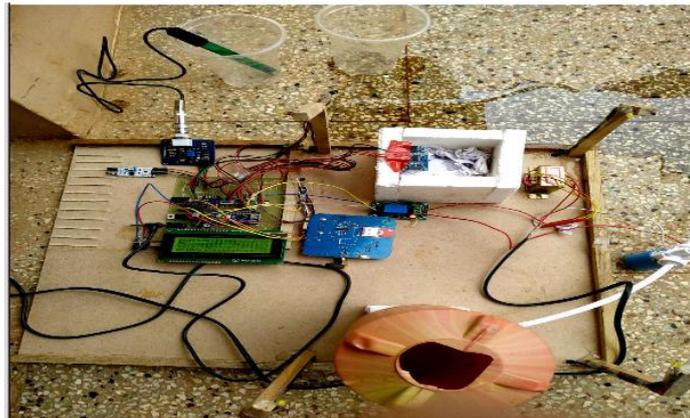


Figure 2: Implementation of a model

Arduino's processor basically uses the Harvard architecture where the program code and program data have separate memory. It consists of two memories- program memory and the data memory. The code is stored in the flash program memory, whereas the data is stored in the data memory. The ATMEGA 328p has 32 KB of flash memory for storing code (of which 0.5 KB is used for the bootloader), 2 KB of SRAM and 1 KB of EEPROM and operates with a clock speed of 16 MHz.

A set of ultrasonic sensors are interfaced with the processor which are in turn mounted on the dust bins so as to monitor the garbage level. Whenever the level reaches to the maximum, then information will be sent to the concerned authorities for quick actions. Ultrasonic sensors are the sound sensors which measure the distance from 2 cm - 400 cm. It has two pins trigger and echo these two pins used to calculate the distance of the object. This sensor generates sound waves which calculate the time duration of the echo that is generated.

When garbage reaches maximum level, the messages are sent to the higher authority through GSM. In GSM the ground is connected to the ground of the Arduino, Vcc is connected to the + 5 V of the Arduino and pin R₁₀ is

connected to the transmitter pin of the arduino. The messages are sent through GSM; it requires Wi-Fi connection. Using ESP 8266 provide the Wi-Fi connection. Here creates one local cloud, in this cloud the data is present, to access the data, create a one IP address. Using that IP address access, the data and sent the messages through the GSM to the higher authority. In ultrasonic sensor duration is converted into distance using formula

$$\text{Distance} = \text{duration} \times 0.034/2$$

Duration = time taken to hit the object

Speed of sound:

$$V = 340 \text{ m/s}$$

$$V = 0.034 \text{ cm}/\mu\text{s}$$

LDR is used when there is a need to control the light automatically. In LDR V_{CC} , GND and output pin is connected to the pin A_2 of the arduino. When the incident light intensity is more on the LDR, resistance of LDR decreases, street lights are OFF automatically. When the incident light intensity is less on the LDR, resistance of the LDR increases, street lights are ON automatically. Figure 6.2 shows the flowchart of the LDR sensor.

IR sensor IR sensor is very sensitive device and its range is 1 cm to 5 cm. It is used to control the buzzer. In IR sensor out, V_{cc} and ground is connected to A_7 pin of the arduino Nano. When train is very near to the IR sensor, it sends signal to the microcontroller, then to the buzzer. In Buzzer the pin ground is connected to ground of arduino Nano and pin out is connected to the D_6 of the arduino Nano. The microcontroller sent the signal to buzzer, when a train very near to IR sensor. The buzzer become high, this indicates train is arriving.

pH sensor is a sensor which measures the quality of a water. It measures of the acidity or alkalinity of a water solution. At 25°C , a neutral solution has a pH of 7.0, while solutions with $\text{pH} < 7$ are acidic and solutions with $\text{pH} > 7$ are alkaline. The normal overall pH range is 0 to 14 pH, although solutions containing non-water solvents can have pH values outside this range. Solenoid valves are used to detect the water leakage in the pipeline automatically.

In the pH sensor there are three connections V_{cc} , ground and out. According to the circuit, V_{cc} , GND and out is connected to the pin A_0 of the Arduino Nano. A neutral water has a pH of 7.0, while water with $\text{pH} < 7$ are acidic and water with $\text{pH} > 7$ are basic. This values are displayed on the LCD.

LCD is connected to the microcontroller digital pins 2,3,9,10,11,12. The microcontroller stores the data, when offers and schemes are released someone stores the data into microcontroller and it will be displayed on the LCD display system.

A solenoid valve is an electromechanically operated valve, the valve is controlled by an electric circuit. It requires 24 V, so here using step down transformer (12:0:12). It steps down the external 250 V to required 24 V. Here single relay is used for opening and closing the switch. In relay the pin INP is connected to arduino 3 V pin (2), GND and Vin is connected to arduino GND and +5 V pin of arduino. Relay N_0 pin is connected to the solenoid valve and pin C is connected to step down transformer. Using solenoid valve water can be distributed to streets automatically, on the time scheduling basis.

RESULTS

Figure 3 shows the level of the garbage filled in the dustbin. When echo (transmitter) signal hits the trash and that signal back to trigger (receiver) is taken as a duration. The duration is converted into distance. when the distance is less than 5 cm messages are sent to the higher authority.



Figure 3: The Image Shows the Level of the Garbage Filled in the Dustbin

The Figure 4 shows the messages from the GSM. When garbage is fully filled, the trigger sent the data to microcontroller, then to GSM. To access data, GSM require Wi-Fi connection, to provide Wi-Fi connection ESP8266 is used. Then GSM access data and sent messages are sent to higher authority.

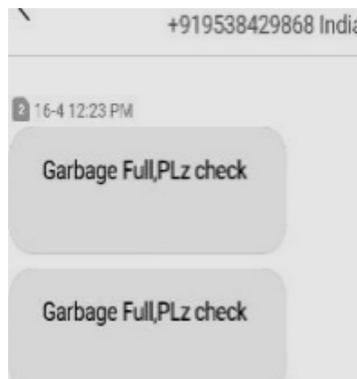


Figure 4: The Image Shows the GSM Messages

FUTURE WORK AND CONCLUSION

Future Work

In the current work the buzzer is used to indicate the arrival of train. As an improvement automatic closing and opening the railway gate. In this project street lights are ON completely during night time. As an improvement lights are made ON when person or vehicle passed under the street lights, which saves the electric power. In the current work single solenoid valve is used to distribute the water. As an improvement more number of solenoid valves can be used to distribute the water to different streets on time scheduling basis. In the IOT based model of smart village the implemented in this current work, can be enhanced to use it in reality with some modification.

Conclusion

Though the investment cost for the project to be implemented in villages is pretty much, it helps reducing manpower for the same. One should also admit the fact that project will result in an environmental friendly, quick responding, disciplined and tidy atmosphere all around the village.

16×2 LCD is used to display the government offer and schemes, also display quality and range of water. If water is ranges from 1 to 6, it displays acidic water, if water ranges from 8 to 14 it displays basic water, if the range of water is 7, displays normal water. To control the flow of water solenoid valve is used. Garbage level is detected using ultrasonic sensor, when it reaches maximum level through GSM messages are passed to higher authority. LDR is used for automatic street light monitoring. Street lights are ON during night time and lights are OFF at day time with the help of LDR. With the help of IR sensor, control the buzzer.

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