"Internet of Things for Smart Water Monitoring System and Smart Bridge Monitoring System"

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Abstract- Today, Internet application development demand is very high. So, IoT is a major technology by which we can produce various useful internet applications. Basically, IoT is a network in which all physical objects are connected to the internet through network devices or routers and exchange data. IoT allows objects to be controlled remotely across existing network infrastructure. IoT is a very good and intelligent technique which reduces human effort as well as easy access to physical devices. This technique also has autonomous control feature by which any device can control without any human interaction. "Things" in the IoT sense, is the mixture of hardware, software, data, and services. These devices gather useful data with the help of various existing technologies and share that data between other devices. Examples include Home Automation System which uses Wi-Fi or Bluetooth for exchange data between various devices of home. Similarly here the system proposed is "The Smart Water Monitoring System" and "The Smart Bridge Monitoring System" . Where the system helps in controlling the false usage of water system provided to the residential areas which could be the major add-on and the smart bridge could serve various other purposes.

Keywords- Internet of Things (IoT), Wireless Sensor Networks (WSN), Water Distribution System, Bridge Monitoring System and Actuators.

I. INTRODUCTION

Today sensors are everywhere. We take it for granted, but there are sensors in our vehicles, in our smart phones, in factories controlling CO2 emissions, and even in the ground monitoring soil conditions in vineyards. While it seems that sensors have been around for a while, research on wireless sensor networks (WSNs) started back in the 1980s, and it is only since 2001 that WSNs generated an increased interest from industrial and research perspectives. This is due to the availability of inexpensive, low powered miniature components like processors, radios and sensors that were often integrated on a single chip (system on a chip (SoC)).

The idea of internet of things (IoT) was developed in parallel to WSNs. The term internet of things was devised by Kevin Ashton in 1999 and refers to uniquely identifiable objects and their virtual representations in an "internet-like" structure. These objects can be anything from large buildings, industrial plants, planes, cars, machines, any kind of goods, specific parts of a larger system to human beings, animals and plants and even specific body parts of them. While IoT does not assume a specific communication technology, wireless communication technologies will play a major role, and in particular, WSNs will proliferate many applications and many industries. The small, rugged, inexpensive and low powered WSN sensors will bring the IoT to even the smallest objects installed in any kind of environment, at reasonable costs. Integration of these objects into IoT will be a major evolution of WSNs.

II. HARDWARE COMPONENTS

In the proposed smart water monitoring system and smart bridge monitoring system, a reconfigurable smart sensor interface device that integrates data collection, data processing, and wireless transmission is designed. The hardware experimental set-up of smart water monitoring system and smart bridge monitoring system is shown in Fig.2(a) and 2(b). The hardware of wireless water quality monitoring system and smart bridge monitoring system comprises the following components:

- Arduino Boards
  a. Arduino UNO
  b. Arduino MEGA
- Sensors
  Float switch sensor
  a. Flow sensor
  b. Ultrasonic sensor
- Actuators
  a. Buzzer
  b. Servo motor
  c. LED's
  d. GSM SIM900A module
  e. Relay module

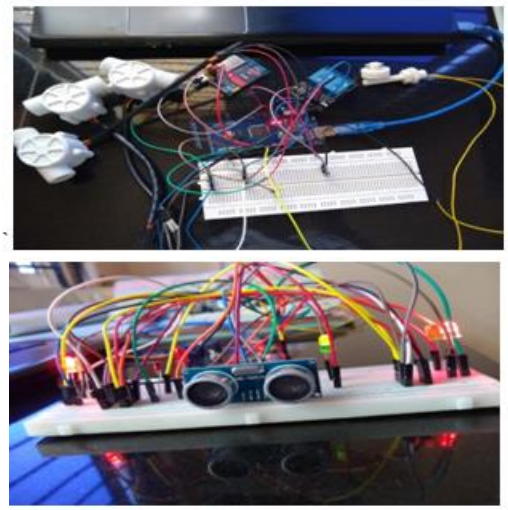

Fig.2: (a) Experimental setup of Smart Water Monitoring System Fig.2:(b)Experimental setup of Smart Bridge Monitoring System

A. Float Switch Sensor

The purpose of a float switch is to open or close a circuit as the level of a liquid rises or falls. Most float switches are "normally closed," meaning the two wires coming from the top of the switch complete a circuit when the float is at its low point, resting on its bottom clip (for example, when a tank is dry).

To complete a circuit, float switches utilize a magnetic reed switch, which consists of two contacts sealed in a glass tube. When a magnet comes close to the two contacts, they become attracted to each other and touch, allowing current to pass through.

B. Flow Sensor

Water flow sensor can be used to measure the flow of liquids, i.e. the consumption of liquids in industrial or domestic usage. For example you can make a robotic cocktail dispensing machine, and can use this sensors to accurately measure components like Soda, Water, etc. Water flow sensor consists of a plastic valve body, a water rotor, and a hall-effect sensor. When water flows through the rotor, rotor rolls. Its speed changes with different rate of flow. The hall-effect sensor outputs the corresponding pulse Signal.

C. Ultrasonic Sensor

Ultrasonic sensor module can be used for measuring distance, object sensor, motion sensors etc. High sensitive module can be used with microcontroller to integrate with motion circuits to make robotic projects and other distance, position & motion sensitive products.

The module sends eight 40Khz square wave pulses and automatically detects whether it receives the returning signal. If there is a signal returning, a high level pulse is sent on the echo pin. The length of this pulse is the time it took the signal from first triggering to the return echo.

D. Buzzer

A "piezo buzzer" is basically a tiny speaker that you can connect directly to an Arduino."Piezoelectricity" is an effect where certain crystals will change shape when you apply electricity to them. By applying an electric signal at the right frequency, the crystal can make sound.

E. Servo Motor

A servo motor is an electrical device which can push or rotate an object with great precision. If you want to rotate and object at some specific angles or distance, then you use servo motor. It is just made up of simple motor which run through servo mechanism.

F. GSMSIM900A

SIM900A Modem is built with Dual Band GSM/GPRS based SIM900A modem from SIMCOM. It works on frequencies 900/ 1800 MHz SIM900A can search these two bands automatically. The frequency bands can also be set by AT Commands. The baud rate is configurable from 1200-115200 through AT command. The GSM/GPRS Modem is having internal TCP/IP stack to enable you to connect with internet via GPRS. SIM900A is an ultra compact and reliable wireless module. This is a complete GSM/GPRS module in a SMT type and designed with a very powerful single-chip processor integrating AMR926EJ-S core, allowing you to benefit from small dimensions and cost-effective solutions.

G. Relay

A relay is an electrically operated switch of mains voltage. It means that it can be turned on or off, letting the current go through or not. Controlling a relay with the Arduino is as simple as controlling an output such as an LED.

II. SOFTWARE

The Arduino integrated development environment **(IDE)** is a cross-platform application (for Windows, macOS, Linux) that is written in the programming language Java. It is used to write and upload programs to Arduino board. Figure 3.1.1.1 shows the general outline of Arduino IDE Blink Program. The source code for the IDE is released under the GNU General Public License, version 2. The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic

functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub *main()* into an executable cyclic executive program with the GNU tool chain, also included with the IDE distribution. The Arduino IDE fig.3 employs the program avrdude to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware.

Fig.3: Arduino IDE working environment

III. RESULTS AND DISCUSSION

In the smart water monitoring system, when the sensor board is switched on, the sensors are activated to detect the individual water parameter data. Then, the collected water parameters are transmitted wirelessly to monitoring device which is PC using Arduino IDE. The proposed smart water monitoring system reduces power consumption, which outperforms the performance of the conventional micro-controllers based WSN. In the smart bridge monitoring system, when the sensor board is switched on, the sensors are activated to detect the obstacles and do necessary actuations based on the sensor parameters.

IV. CONCLUSION

The proposed Smart Water Monitoring System and Smart Bridge Monitoring System prototype works efficiently future enhancement can be done by adding TDS sensor to the water monitoring system, the system helps in controlling the false usage of water system provided to the residential areas which could be the major add-on and the smart bridge could serve various other purposes.