Railway & Highway Bridge Safety by Using Automation, Electrical Drives Using GSM

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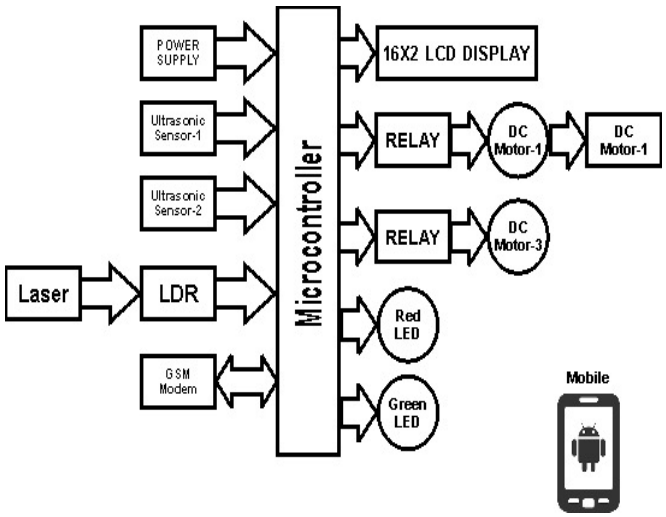
Abstract - This paper proposes a wireless solution, based on global system for mobile communication (gsm) network for the monitoring and controlling of the river water level parameter. one of the advantages of the system is that it can be used for monitoring decrement of water level in the rivers and water level rising in case of flooding. the system at a certain interval continuously sends river water level measurements to the concerned authority with water environmental flow management. but once the river water reaches the critical level either by decreasing or flooding, an alarm will be sent via gsm network to the personal in charge, furthermore, the proposed system allows on-line configurations of the system equipment's at the field. this system, uses open access platform pic16f877a as main controller, ultrasonic sensing equipment and web infrastructure that allows remote access of information from any place of the country.

I. INTRODUCTION

To monitor the level of water is often a key requisite in river. Moreover, to detect the water level of water through wire communication is not a flexible and tedious ways. For this purpose a robust, real time, portable and easy to operating system is needed for monitoring the level of water. There are much of the technologies used today to execute the basic tasks as water-level measurement, health of the bridge and so on. For monitoring the level of water, the system is a kind of structure which measures water deepness through ultrasonic sensor technology. Modern microcontroller and wireless sensor can provide a range of solutions for the automated monitoring of water levels in many applications. in most of the cases, costly radio modems are employed for fastest access of remote data, because it provides a long-distance and reliable radio link between the sensor networks. Simultaneously, the processed digitized data is transmitted via a wireless network to a remote location or device. in another sense, the transmission step is made over a wireless network control channel using gsm. Bidges are continuously subjected to destructive effects of material aging, widespread corrosion of steel reinforcing bars in concrete structures, corrosion of steel structures and components, increasing traffic volume and overloading, or simply overall deterioration and aging. These factors, combined with defects of design and construction and accidental damage, prompt the deterioration of bridges and result in the loss of load carrying capacity of bridges. The condition of heavily used urban bridges is even worse: one in three is classified as aging or unable to accommodate modern vehicle weights and traffic volume.

II. BLOCK DIAGRAM



BLOCK DIAGRAM DESCRIPTION

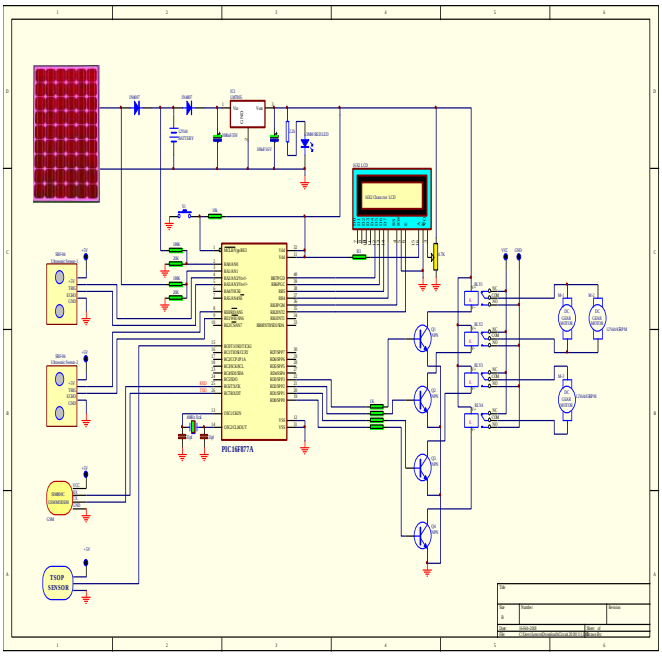
Above block diagram represents the complete architecture of the proposed system. This architecture of the system consists of all the required peripheral devices included in this system. The system consists of a microcontroller which the brain of the complete system. In this system a microcontroller atmega88pa is used for the controlling of the complete system. To provide the required power supply to the system components a power supply unit is designed and placed in the hardware of the system. This power supply unit provides the regulated power to the circuit components as per their requirement. In this prototype a solar panel is used to generate power from the sun light. This solar panel generates energy and provides it to the battery for the storing purpose and when the module is turned on this battery will provide the power to the circuit. The system consists of two ultrasonic sensors placed in the down side of the bridge and it is interfaced with the microcontroller as shown in the above architecture of the system. These ultrasonic sensors are used to measure the water level in the river. In this system ultrasonic distance sensor-pwm out type of sensors are used to provide pulses to

the microcontroller for the increasing water level in the river. In this system a laser and a ldr are connected to both the end side of the bridge. This arrangement of the laser and ldr is used detect the breakdown of the bridge. These laser and ldr are also interfaced with the microcontroller as shown in the above architecture of the system.

In this prototype two doors are designed at both ends of the bridge. These doors are controlled by the microcontroller. When the water level in the river reaches the danger level marked or set in the system, the doors will be closed by the microcontroller for the traffic and red indications will be turned on. And in normal condition when there is normal water level in the river the green indication will be on continuously. For this indication purpose a red and a green leds are used in this prototype system. To open and close the doors at the end points of the bridge two dc motors are used in this system as shown in the circuit diagram of the system. These motors are interfaced with the microcontroller and are controlled through relay as shown.

In this system a parallel bridge to the main bridge is also taken in the consideration and it is designed as shown in the hardware of the system. This parallel bridge is useful for the vehicles during rush. when accident will be occurred to any of the vehicles i.e. if the vehicle falls from the main bridge on the parallel bridge, the parallel bridge will be move in upward direction to provide help to the human being in the vehicle without waiting for the fire brigade or other help service to take the vehicle up. This accident detection will take place with the help of a tsop sensor interfaced in this system. This tsop sensor is used as obstacle detector sensor. When the vehicle falls on the bridge an obstacle gets detected by this tsop sensor. A dc motor is used to move the bridge in up and down direction as shown in the architecture of the system. This dc motor is also interfaced with the microcontroller and connected through a relay. The system consists of a lcd display used to display the status of the water level in the river, status of the doors and condition of the bridge. This is a 16x2 lcd display interfaced with the microcontroller as shown in the architecture of the system. The system includes a gsm modem as shown in the above block diagram of the system. This gsm modem is used to send the sms to the controlling center about the water level and bridge condition or about the accident if any. This gsm modem is interfaced with the microcontroller and sends sms to the mobile number saved in the memory of the microcontroller. In this system we have used a sim800 gsm modem for the above mentioned purpose of sending sms. This gsm modem is interfaced with the microcontroller with thea matching device max232. This sim800 gsm modem has inbuilt max232 for the ttl and cmos level matching between microcontroller and modem.

III. CIRCUIT DIAGRAM



CIRCUIT DESCRIPTION

In this system a 12v battery is used to provide required power to the circuit for its desired operation. A 12v/15w solar panel is used to recharge the battery from solar energy. a microcontroller used in this system and other components in the circuit require a constant 5v supply. This 5v supply is obtained from the regulated ic 7805. This regulator provides constant and regulated power of 5v. The capacitor filters are used to eliminate the ripples present in the supply.

This supply is provided to the pic controllers at pin no 1. at pin no 1 of pic we have connected a switch and the other terminal of the switch is connected to ground. so that when this switch is pressed the supply to the controller will be directly transferred to ground and in this way the controller gets reset.

A crystal of 4 mhz is connected at the pin no 13 and 14 of the pic controllers. Two capacitors are also connected in parallel at both the terminal of the crystal. This forms a crystal oscillator which provides machine cycle to the controller. pin no 31 and 12 are connected to the ground and pin no 32 and 11 of pic controllers are connected to 5v supply.

In this system the ultrasonic sensors are interfaced with the microcontroller for the measurement of the water level of the river. This ultrasonic sensors are pulse width modulation out sensors to measure the distance between two vehicles. Ultrasonic distance sensor provides range from very short (2

centimeters) to long-range (5 meters) for applications in detection and ranging. The sensor provides precise and stable non- contact distance measurements from about 2 cm to 5 meters with very high accuracy.

The ultrasonic sensor can easily be interfaced to microcontrollers where the triggering and measurement can be done using two i/o pin. The sensor transmits an ultrasonic wave and produces an output pulse that corresponds to the time required for the burst echo to return to the sensor. By measuring the echo pulse width, the distance to target can easily be calculated. This ultrasonic sensor is implemented on the down surface side of the bridge for the water level measurement in the river. In this system the trigger and echo terminals of the first ultrasonic sensor are connected to the pin number 4 and 5 in port a of the controller ic respectively as shown in the circuit diagram of the system. Whereas the trigger and echo terminal of the second ultrasonic sensor are connected to the pin number 8 and 9 of the controller ic respectively as shown in the circuit diagram.

IV. CONCLUSION

The current research work illustrates the design and performance of a real-time monitoring system for measuring water level. The developed system mainly highlights the functional characteristics with wireless network capacity, sensor hardware compatibility (ultrasonic sensor), low cost production and efficient capture. The system also has the low-power consumption and has negligible impact on the environment. The tested result from the system reports good outcomes which is energy resourceful, has strong communication ability, and presents real-time measurement accuracy. Also the system has ability to provide help to the fallen vehicle without wasting time for the fire brigade and other emergency services during the occurrence of the accident.

V. REFERENCES

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