

# Intelligent border using wireless sensor network (WSN)

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**Abstract**— A safe border is a main concern for many governments nowadays, WSN is a proper tool for establishing that goal. It can gather information about physical environment such as temperature, pressure, noise even image and send these information to logical devices. WSN is considered essential in several aspects such as medical and military applications especially in border monitoring. WSN has the advantage of low cost and low power. In this paper an intelligent algorithm is used to design a (WSN) for border security. It consists of a small entities (nodes) each node consists of micro-controller integrated with required sensors (PIR, sound, vibration, and motion detection sensors) and combined with camera provided by its Wi-Fi communication system. An intelligent fuzzy algorithm is used for diffusion of the sensors data and in addition the decision making. The proposed system has a simple graphical user interface (GUI) which is thought to be proper for usage in a lot of fields.

**Keywords**— WSN, Micro controller, Sensor and Artificial intelligence.

## 1-Introduction

Nowadays border monitoring is very important issue because terrorism becomes one of the greatest threats for national security. Since the area, which should be protected, is normally large, open, and complex, so it cannot be monitored by regular forces or even satellites.

Wireless sensor network system combines sensor technology, embedded computing technology, distributed information processing and communication technologies, and real-time collaborates to monitor, build and sample regional distribution networks within the target environment or monitoring information, and processes such information to get detailed and accurate information transmitted to the information needs of users. So, WSN is one of the hot research directions and has tremendous scientific importance and application prospects. Wireless Sensor Network promise great advantages in terms of flexibility, cost, autonomy and robustness with respect to wired ones.

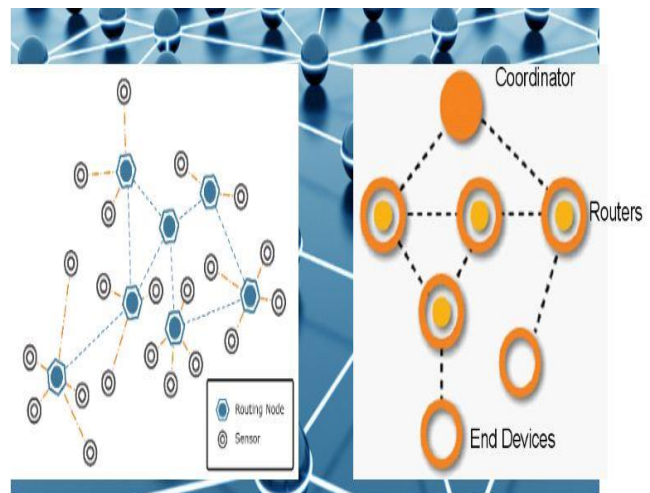


Fig.1. WSN examples

## 2- The proposed System structure

In the WSN security system presented in this article, we took a network topology structure which is showed in Fig. 1.

The system employs distributed structure, which consists of many micro-sensor nodes, communication network and monitor center (computer). For a short distance transmission, the micro-sensor nodes collect data from the monitoring surrounding and transmit to the monitor station using ZigBee communication. For a long distance transmission, from the gateway to the monitor center (theoretically).

But in this research the short distance is module is applied.

In each node of the system four sensors are used together to collect data from the surrounding environment and confuse these data together to form output that is should be clear from fault alarm to confirm the data camera kit is used using image classification technique and video link to provide to user, the main power supply to the system is the solar cell.

## 3- Design of a Wireless sensor node

The wireless sensor node is a data-acquisition organ. The hardware block diagram is showed in Fig.2. It consists of processing unit, sensing unit, control unit, communication unit and power support unit. In this article (Adriano Uno / MSP-430) kit are used as a microcontroller and wireless communication system. It is power efficient to the power provided by the solar cell in addition it is a small size kit that is proper to make the node as small as possible, data processing step is done on the micro controller itself , sensing function is done using four sensors that are passive infra-red ,sound ,vibration and motion detection sensors ,each sensor collect its own data and send to the micro controller and using the fuzzy code uploaded on the micro controller, these data is gathered together and the

output is determined if there is a threat according to the input data.

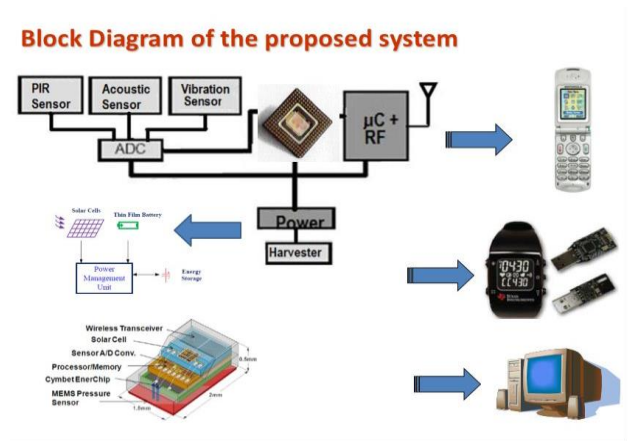


Fig.2 Block diagram of the proposed system

The system is fed by power from solar cells which guarantee a long life time for the system ,finally the host can be computer ,mobile or a watch which is an advantage provided by msp-430 kit.

## 4- Intelligent code structure

In this section we are going to give some conditions and know the expected response of the system.

If a human detected (pir-motion detection) sensors will give alarm for both the user and camera to open if camera detect person it would send the video, if not, it will considered to be fault alarm.

If a vehicle detected (motion detection-vibration-sound) sensors will give alarm for both the user and camera to open if camera detect vehicle it would send the video, if not, it will considered to be fault alarm.

If any sensor send a fault alarm nothing will happen.

The sequence of system operation is explained in flow chart shown in figure4.

Fig4 (system flow chart)

## 5- System Implementation and Testing

Each sensor tested individually to select its proper code then the whole system sensors are implemented using intelligent code together then the transceiver circuit is entered to the system.

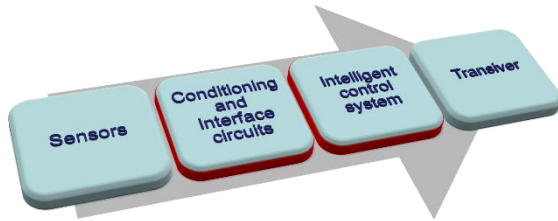
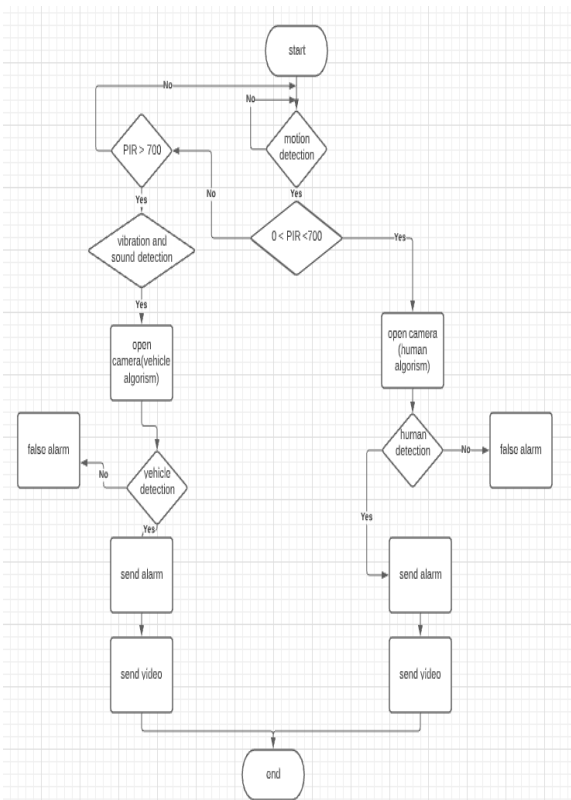
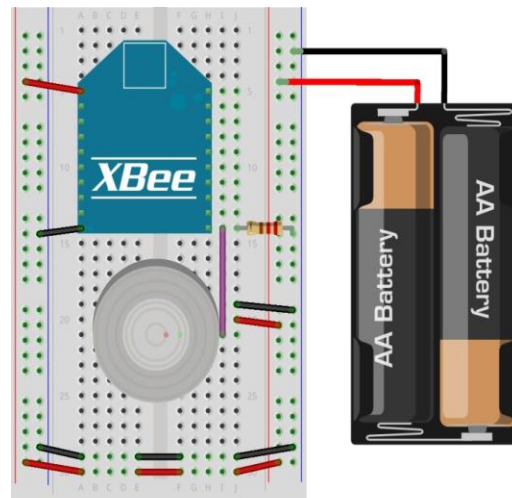


Fig3 (system develop steps)



### 1- Sensor and Transmitter Circuit

System circuit are implemented together and with transceiver circuit as shown in figures below.



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Fig5 (transmitter circuit circuit diagram)

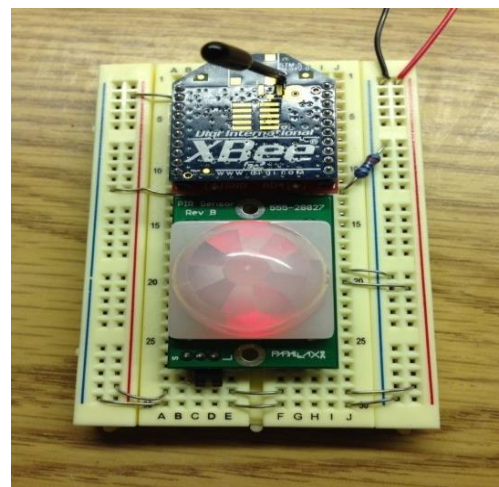


Fig6 (transmitter circuit circuit)

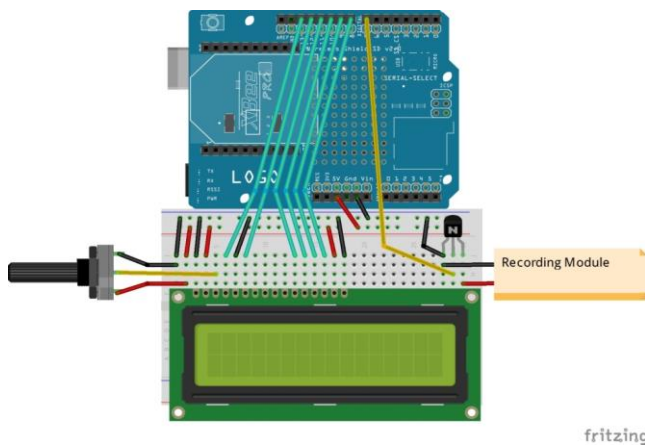


Fig7 (system sensor interface circuit diagram)

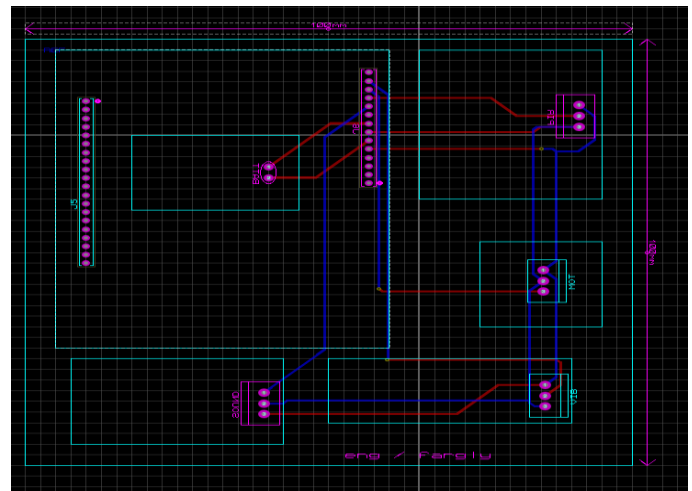


Fig9 (PCB layout)

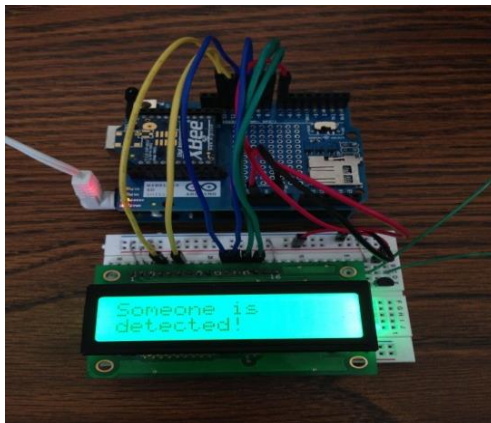


Fig8 (system sensor interface circuit)

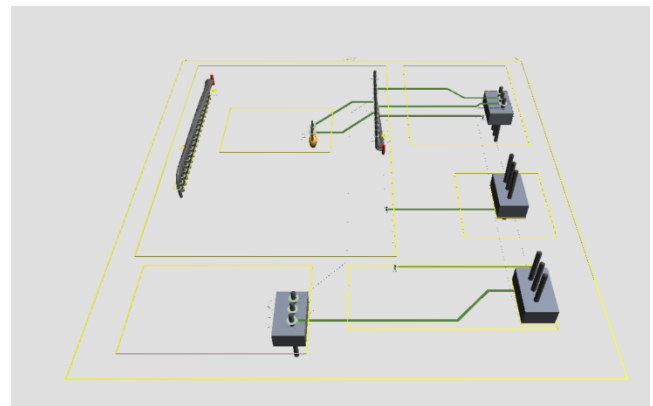


Fig10 (PCB sensor 3D model)

## 2- Interface and Receiver Circuit

A simple GUI is introduced using python to facilitate the usage of the system and interfaced with receiving circuit

## 3-Printed circuit board (PCB) design

All system component are implemented in a single PCB shown in figures below.

## 5- Conclusion

This paper presents a WSN project based on ZigBee technology to be used in self-security field. The theoretical analysis and the experiments confirm that this project design reasonably, hardware system work normal, the software procedure compiled for WSN is correct. It has the very great practical value. Believed that, with continuous progress of scientific technology, especial the overcoming of some key problems in

Sensor networks, the application prospect of this design is very optimistic in the security domain. [9]

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