

PRISONERS SURVEILLANCE SYSTEM

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Abstract - Now a day's population inside the prison has been increased and prison officers are the responsible person for continuous supervision, security and safety of the inmates. But due to the criminal thought and the misbehaviors of some inmates others are also affected which will create a lag on peaceful environment inside the prison. The inmates inside the prison are also attacked by the prison officer vulnerability due to some wrong motivation or politics. The inmates may also try to suicide or self-harm them due to physical or mental torture and also consume alcohol and drug products. The inmate also tries to escape from the prison. In order to avoid this, we have introduced an electronic monitoring system which will supervise the inmate's health condition and location. Inmate's health condition can be monitored using heart rate sensor, temperature sensor and to monitor whether the inmates are consuming drugs by using alcohol sensor and if inmates are attacked by prison officers accelerometer sensor is used to identify the sudden fall or abrupt change on their body movement. These real time data are collected and transferred using wifi transmitter fitted in the inmates and the receiver side is monitored by the higher officers.

Key Words: Prison, Vulnerability, Electronic Monitoring System, Sensors, Inmates, Real Time Data, Officers, Transmitter.

1. INTRODUCTION

The closed nature of penal system makes it easier for any kind of abuse to go unnoticed and unattended. Therefore, it becomes extremely important to hold the functionaries of prison accountable for their actions. To this end, multiple oversight mechanisms have been instituted in India either by legislation or regulation to ensure that the prison conditions are monitored regularly and the rights of prisoners is upheld notwithstanding the isolation of the place they are detained in Prison Visiting System and under trial Review Committees are two such mechanisms that call for regular inspections in prison by government stakeholders, civil society members and judicial officers. The mandate of Prison Visiting system has a wider ambit and requires the visitors to ensure that all rules and regulations are being carried out to their satisfaction. The Under-trial Review Mechanism centres on reviewing the cases of under trials who have been in detention for longer than legally required. Both the mechanisms purport to bring the state of prisons and prisoners to the notice of government and higher judiciary. The aim is to curb the deficiencies before they accumulate or grow into unmanageable proportions.

Today, these monitoring mechanisms have become perfunctory and prisons are not being monitored in accordance with law. This has led to unhygienic conditions, high incidence of abuse and prolonged and unnecessary detention of under trials. We work towards retaining and reinforcing the institution of prison visitors and promoting the creation and regular functioning by using this inmates monitoring system

1.1 Wi-Fi

Wi-Fi is a popular wireless networking technology. Wi-Fi stands for "wireless fidelity". By using this technology, we can exchange the information between two or more devices. Wi-Fi has been developed for mobile computing devices, such as laptops, but it is now extensively using for mobile applications and consumer electronics like televisions, DVD players and digital cameras. There should be two possibilities in communicating with the Wi-Fi connection that may be through access point to the client connection or client to client connection. Wi-Fi is a one type of wireless technology. It is commonly called as wireless LAN (local area network). Wi-Fi allows local area networks to operate without cable and wiring. It is making popular choice for home and business networks. A computer's wireless adaptor transfers the data into a radio signal and transfers the data into antenna for users.

1.2 IoT

The Internet of Things (IoT) is a dynamic system which consists of interrelated computing devices, digital and mechanical machines, animals, plants, objects or even people that are provided each with a unique identification and with the ability to transfer the data over by a network without requiring any human to computer intersection or human to human interaction.

A system of IoT consists of various sensors and devices which can talk themselves to the cloud through a form of connectivity. Once the data gets connected to cloud, the software makes process it and then it can decide to take an action, such as providing with an alert or automatically performing the adjustment in the sensor and device without the help of the interface of the user.

2. SENSORS AND DEVICES

2.1 Accelerometer Sensor

The rate of change of velocity of the body with respect to time is called acceleration. According to relative theory, depending upon the relative object taken to measure acceleration, there are two types of acceleration. The proper acceleration, which is the physical acceleration of the body relative to inertia or the observer who is at rest relative to the object being measured. The coordinate acceleration depends upon the choice of coordinate system and choice of observers. This is not equal to proper acceleration. Accelerometer sensor is the electromechanical device used to measure the proper acceleration of the object.

2.2 Alcohol Sensor

An alcohol sensor detects the attentiveness of alcohol gas in the air and an analog voltage is an output reading. The sensor can activate at temperatures ranging from -10 to 50°C with a power supply is less than 150 Ma to 5V. The sensing range is from 0.04 mg/L to 4 mg/L, which is suitable for breath analysers.

The MQ-3 alcohol sensor consists of total 6-pins including A, H, B and the other three pins are A, H, B out of the total 6-pins we use only 4 pins. The two pins A, H are used for the heating purpose and the other two pins are used for the ground and power. There is a heating system inside the sensor, which is made up of aluminum oxide, tin dioxide. It has heat coils to produce heat, and thus it is used as a heat sensor.

Characteristics of Alcohol Sensor:

- Good sensitivity to harmful gases in wide range.
- It has long life and low cost.
- Possesses high sensitivity to ammonia, benzene, sulphide gases.
- It is a simple drive circuit

2.3 Temperature Sensor

A simple temperature sensor is a device, to measure the temperature through an electrical signal it requires a thermocouple or RTD (Resistance Temperature Detectors). The thermocouple is prepared by two dissimilar metals which generate the electrical voltage indirectly proportional to change the temperature. The RTD is a variable resistor, it will change the electrical resistance indirectly proportional to changes in the temperature in a precise, and nearly linear manner.

Characteristics of Temperature Sensor:

The measurement of the temperature sensor is about the hotness or coolness of an object. The working base of the sensors is the voltage that read across the diode. If the

voltage increases, then the temperature rises and there is a voltage drop between the transistor terminals of base & emitter, they are recorded by the sensors. If the difference in voltage is amplified, the analogue signal is generated by the device and it is directly proportional to the temperature.

By using the temperature sensor, the temperature can be measured by four measurement scales and they are divided into different degree units. The metric Celsius scale is used by the measurement scale and they start from zero. The Fahrenheit temperature sensing uses the Rankin scales and these scales are absolute scales. The Rankin scale measures the absolute zero as the 492 degrees Rankin. The temperature sensor determines the absolute zero measurements as close to the minus 46 degrees Fahrenheit.

2.4 Heartbeat Sensor

The inmate's health condition is monitored using heart beat sensor and temperature sensor. Location of the inmates is monitored using GPS and to monitor whether the inmate is consuming alcohol or other drug product using alcohol sensor. To identify if the inmate has a sudden fall or drift then it can be identified by accelerometer sensor. These data are transfer to the higher officer through WIFI module which will transfer data at high speed. The PIC microcontroller is used to process this data from the sensor and transfer the data through the WIFI.

The heartbeat sensor is based on the principle of photo plethysmography. It measures the change in volume of blood through any organ of the body which causes a change in the light intensity through that organ (a vascular region). In case of applications where heart pulse rate is to be monitored, the timing of the pulses is more important. The flow of blood volume is decided by the rate of heart pulses and since light is absorbed by blood, the signal pulses are equivalent to the heart beat pulses.

2.4 GPS Location Monitor

The Global Positioning System (GPS system) is a satellite-based navigation system made up of a network of 24 satellites placed into orbit. The GPS works in any weather conditions, anywhere in the world, 24 hours a day. GPS satellites circle the Earth twice a day in a orbit and transmit signal information to the Earth. GPS tracker (reviser) takes this information and use trilateration to calculate the vehicle's exact location.

The GPS tracker compares the time a signal was transmitted by a satellite with the time it was received. The time difference tells the GPS tracker how far away the satellite is. Now, with distance measurements from a few more satellites, the GPS tracker can determine the vehicle's exact location and display it on the map and thus you can see it on your PC or smart phone screen. The GPS tracker must be locked on to the signal of at least 3 satellites to calculate location of the vehicle – latitude and longitude and vehicle movement.

With four or more satellites in view, the GPS tracker can determine car's location with three parameters – latitude, longitude and altitude. Once the car's location has been determined, the GPS tracker can calculate other information, such as speed, track, trip distance, distance to destination, idle time, parking time and more.

It's no understatement calling this technology a miracle, a pocket size device that can pin point its location anywhere on earth. Simply known as a GPS (Global Positioning System), it's the modern world's answer to the compass.

2.6 PIC MICROCONTROLLER

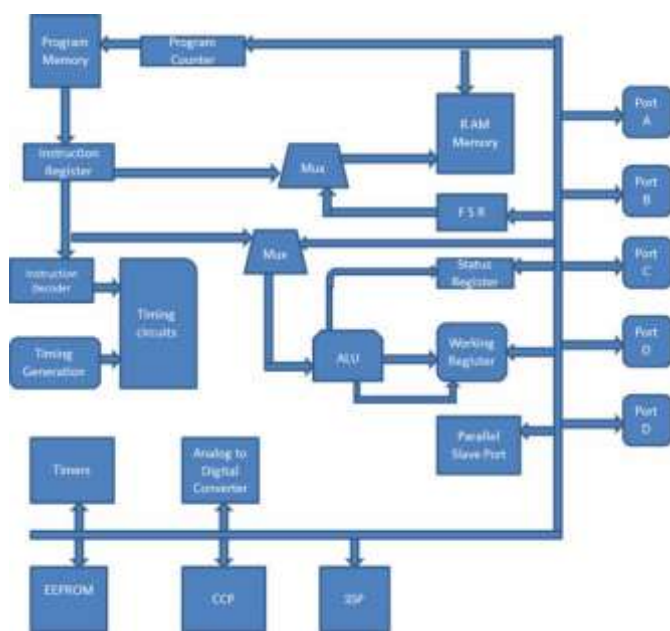


Fig - 1: Architecture of PIC Microcontroller

PIC microcontrollers were electronic circuits to execute a broad range of tasks. We can be programmed as timekeepers for a production line and much more to track. These are accessible on almost all electrical products including detectors, computer control systems and computers.

There are some registries and a stack in the PIC Microcontroller architecture that function as Random Access Memory (RAM) and which holds the return addresses. The principal features of PIC Microcomputer are RAM, Flash Memory, Quick Memory, Timers/Comters, EEP ROM, I/O Ports, USART, CCP (Capture / Compare / PWM module), SSP, Comparator, ADC (Digital Converter Similar), PSP (parallel slave port), LCD and ICSP (Serial Programming Circuits).

Advantages of PIC Microcontroller:

- The PIC intensity is much less harmful, we are optimistic.
- Power generation is also much simpler in tandem with other microcontrollers. We may link analog devices

directly, when we see that the design of the programmer's point of view is quite simple. The other microcontrollers are also incredibly easy to program. It is a RISC (Reduced Instruction Set Computer) design

- Only thirty seven instructions to remember
- Its code is extremely efficient, allowing the PIC to run with typically less
- Program memory than its larger competitors.
- It is low cost, high clock speed

3. PROPOSED SYSTEM

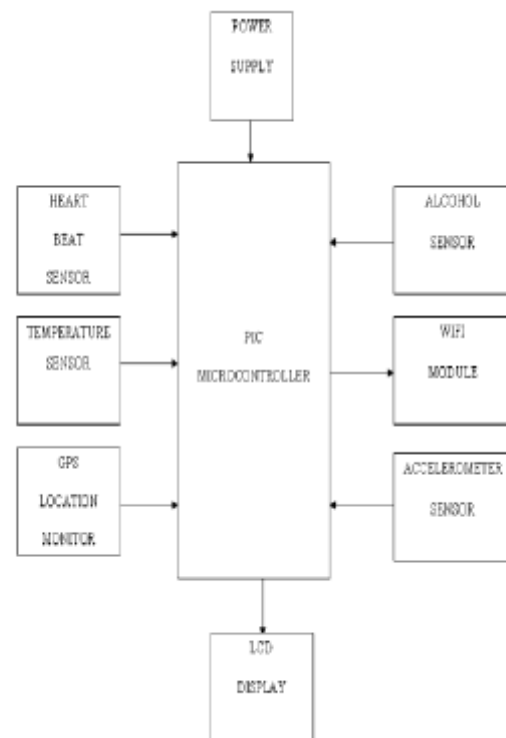


Fig - 2 : Block Diagram of Prisoners Surveillance System

The inmates health condition is monitored using heart beat sensor and temperature sensor. Location of the inmates is monitored using GPS and to monitor whether the inmate is consuming alcohol or other drug product using alcohol sensor. To identify if the inmate has a sudden fall or drift then it can be identified by accelerometer sensor. These data's are transfer to the higher officer through wifi module which will transfer data at high speed. The PIC microcontroller is used to process this data from the sensor and transfer the data through the wifi.

The above block diagram shows the various sensors which are implemented with PIC microcontroller and the data's which are gathered and the analysed information's are transmitted through the Wi-Fi module to the cloud server.

4. RESULTS

The overall view of the prototype which consists of PIC Microcontroller, Heart Beat Sensor, Infrared Sensor, Temperature Sensor, Alcohol Sensor, Accelerometer Sensor, GPS Module, Wi-Fi Module, LCD Display and Transformer.

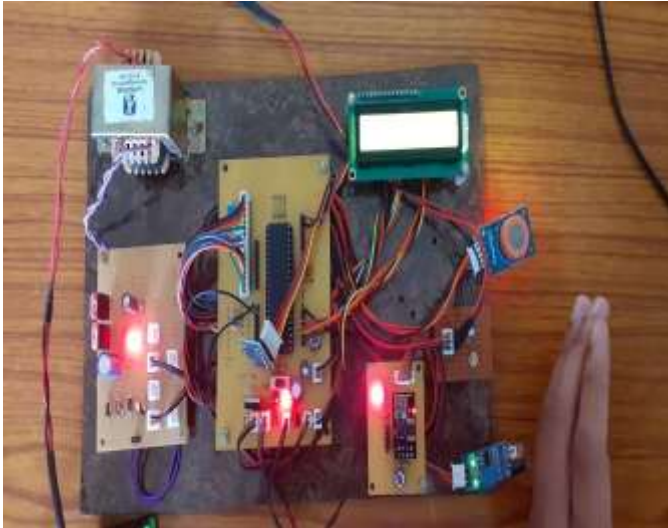


Fig - 3: Prototype

Here, all the sensors are working under the DC voltage of 5V. The 230V AC is being stepped down to 5V DC using step down transformer and the then passed through bridge rectifier to supply the complete 5V DC to the microcontroller and all the sensors. The PIC Microcontroller gets the analog input form all the sensors and then it process the analog input into digital output and thus the parameters are displayed in the LCD display and also transmitted through Wi-Fi module to the cloud.



Fig - 4: Heartbeat Sensing



Fig - 5: Temperature Sensing

Thus, by using this inmates monitoring system we can seamlessly monitor the inmates in the prison. This will help in maintaining habitation and also can prevent vulnerable activities or any violation of prison rules. This project will also give equal importance's to inmates health condition with continuous monitoring of heart rate and temperature.



Fig - 6: Data Collected in IoT

The Data that are get sensed in the prototype is then transferred to the IoT platform and the which are sent is visible in the web server both in Personal computers as well as smartphones.

5. CONCLUSION

This project will provide security, safety and also can maintain regulation inside the prison. A high speed inmate monitoring system has been designed. In future it can also be used to track inmates when they move out of prison for their career. Hence the total surveillance are at one place and it makes the management easy for maintaining persons.

6. FUTURE WORKS:

The proposed prototype will be designed into compact structure. The design is made into a wearable gadget for ease of implementation. The proposed design will be elevated in 3D model. The design can be made into a portable device.

REFERENCES

1. Applications of Video Surveillance System in the Prison. Zhuhai Swiss News Technology Co., Ltd. China Security Product Information Market Edition, Apr.2005.
2. Hai Hu, Solutions for Monitoring and Management System of Prison Network. Security Project.Nov. 2009.
3. Jianming Cui, Chengyi, Wang, Qingjun Xue. Smart TV Monitoring Mystem Design in Prison. Qingdao University. Dec.2003.
4. Dongxin Lu, Wenlong Xu, Licun Wang. Wireless Sensor Networks. Industrial control computer. 2005,18 (4).
5. Huazhong Zhang. Looking for Wireless Sensor Networks. The international academic action. Apr .2005.
6. Youbing Feng, Rongbiao Zhang, Guodong Gu. The Application of Wireless Sensor Networks in Water-saving Irrigation. China's rural water conservancy and hydropower. Feb.2007.
7. JieRui Xie, Caixing Liu, Mingyue Hu. The Deployment of Wireless Sensor Networks. Sensors and Microsystems .2007,1 (26) :4-7.
8. Application and Research of Animal Survey System Based on Wireless Sensor Networks. Huiqiang Lin, Peijiao Zhou, Caixing Liu. Agricultural Research. 2009,1.
9. Li, S. The Applications of Wireless Sensor Network Technology in Coal Mine Safety Monitoring System for 61 Human Body. Chinese New Technology and New Products • Industrial Technology. 2008,10 (below).
10. Lin, H. Wireless sensor network node localization and implementation. Telecommunications technology. 2007,10.
11. Tian, J. Wireless Sensor Network Nodes Targeting Improved Algorithm. Shanghai University (Natural Science Edition).2009,8.
12. Yi, X. Simulation and Analysis of Range-Free Self-Location Algorithm for Wireless Sensor Network. Journal of Naval Aeronautical and Astronautical University. Jul.2009.
13. Cao, X. Research on location of node for wireless sensor networks. Information technology. Jul 2009.
14. Liu, S. DV-Hop Localization Algorithm Based on Estimate of Average Hop Distance and Correction in Position. Chinese Journal of sensors and Actuators. Aug.2009.
15. Bai, J. Research of Location Based on Mixed Algorithm of Weighted Centroid and DV-Hop in WSN. Application Research of Computers. Vo1. 26 No. 6, Jun. 2009.
16. Niculescu D. Positioning in Ad hoc sensor networks [C]. IEEE Network, 2004, 18 (4): 24-29.
17. Lindsey S. PEGASIS : Power-Efficient gathering in sensor information systems[A] - IEEE Aerospace Conference Proceedings [C]. 2002,3 : 1 125-1 130
18. Routing Protocol for Wireless Sensor Networks. Peng Li. Telecom Express .2007,4.
19. Fang, X. A new LEACH-based Routing Algorithm for Wireless Sensor Networks. Mechanical & Electrical Engineering Magazine. Vo1 25 NO5, May. 2008