

# STUDY OF ATTENDANCE MONITORING SYSTEM USING GAIT MECHANISM

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**Abstract**— In today's world maintaining of attendance related data is very essential and vital in many sectors like educational institutions, co-operate companies, industries, hospitals and so on. The common method which is used nowadays for maintaining such data is inefficient and it can cause errors. The issues of conventional method are replaced with biometric authentication techniques. The significant role possessed by the technique is a person's authentication is based on his/her own biometric features. Some of the biometric techniques are: iris, fingerprint, face, DNA recognition and in this paper, the study of gait phenomenon is considered. Gait deals with the walking mannerism in which the attitude of an individual's walk is considered for authentication purpose. In order to avoid the manual work in data acquisition and managing the complete database of all the details up to date, different types of biometric measurements are utilized, in which the latest approach is gait phenomenon. Here the walking manner recognized from an object is compared with the image clipping stored in the database by which the attendance is monitored. Thus, by making fully automatic, manual work is reduced since there is no intervention of human work in maintaining the attendance details.

**Keywords**— a web server using raspberry pi system; data acquisition; efficient attendance management system; gait mechanism.

## I. INTRODUCTION

Attendance is for verifying the presence of students, staves in schools and colleges and also to ensure the number of absentees. In any organization, the verification of attendance of bottom level and middle level is done by the top level management. The above strategies are to sustain the standards of institutions and organizations. The alternatives regarding the changes lead to compete with significant consequences. The attendance process is more important nowadays. More attention must be taken for the above process. The conventional method of attendance marking is through mentioning the names of pupils, staves, employees at the institutions and work place. The other techniques like: RFID cards, fingerprint, recognitions are also implemented for taking attendance. Though the

above mentioned conventional methods were cheap and reliable, it turns tedious when count crosses certain criterion. These methods are human intervention methods. The modifications are necessary to be done by human beings alone and every time a computer backup is to be done by us.

Thus, a solution for the above mentioned drawbacks can be overcome through latest techniques which have an advantage of universal compatibility.

In this paper, there are presences of two hardware devices: The first one is a handheld device which will be placed in every classrooms and the second is the web server for all the handheld devices in network.

This paper consists the following: Section II deals with hardware components and section III deals with software components.

## II. HARDWARE COMPONENTS

Attendance monitoring system deals with hardware which has two sub-systems:

1. The first system is handheld equipment for the purpose of monitoring and transmitting the attendance details.

2. The second system is ZigBee based local server for monitoring all the devices connected in the network and updating the attendance details in a regular fashion.

Handheld device in every classroom is used to transmit the attendance details to the local web server where the complete attendance management is done. The raspberry pi server is used in this system in order to maintain the attendance details in excel format. ZigBee act as an interface between the devices to provide a complete automation technology in the digital circuitry. It has feature of low power consumption, low cost and simple implementation. Remote monitoring and controlling is an added feature to it. There are different types in ZigBee as: coordinator, router and end device. These networks are also provided with individual PAN IDs for better peer to peer communication between the devices.

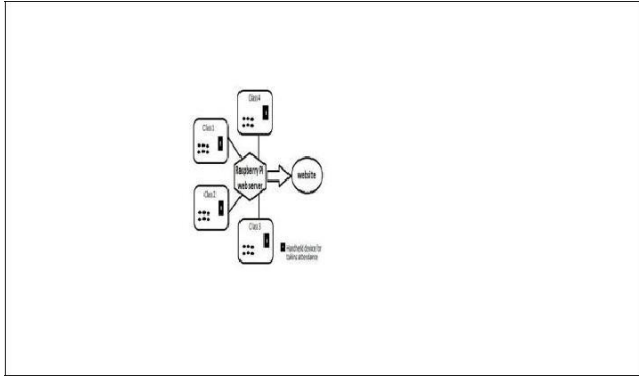


Fig. 1 System architecture

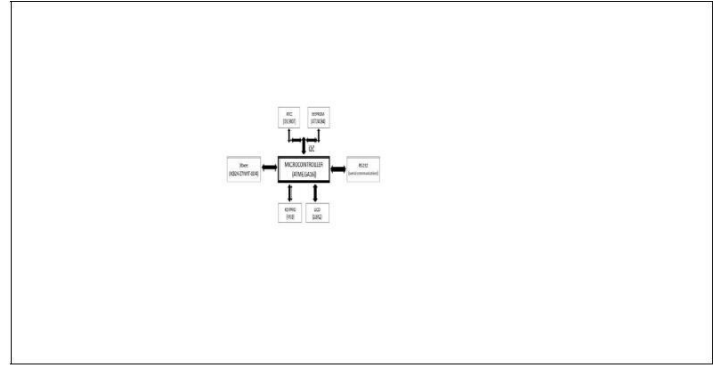


Fig. 2 Block diagram of handheld device

### A. Handheld Device

It is the foremost element in this system. It consists of components like: A low power AVR ATMEGA16 of ATMEL CMOS 8 bit microcontroller of Reduced Instruction Set Computing (RISC) core of modified Harvard architecture setup. For storing the complete attendance details, EEPROM is an important apparatus. AT24c64 EEPROM of ATMEL which provides serial memory type electrically erasable programmable read only memory organized as 8 bits with 8192 words each could be selected with 65536 bits. The SDA (Serial Data Line) and SCL (Serial Clock Line) are the two functioning wires in bus with grounded connections. These possess bidirectional character. Real Time Clock (RTC) - DS1307 module is a computer clock that keeps track of the current time and it is responsible for maintaining accuracy of time.

Liquid Crystal Display (LCD) - 016M002B with excellent contrast, energy efficient and low power acts as an interface to the user. XBEE XB24-Z7WIT-004, to transmit data from the handheld device to the server through the wireless medium.

The handheld device works on the power supply of 5V dc. An adapter with specification 12V, 1Amp and IC7805 are used to maintain constant voltage in power supply unit. A 9V battery could also serve all its power requirements. Low power of ZigBee is its important feature. The merit of this system is its low power, low cost and high processing speed.

The functions provided are as follows:

- i) Attendance function
- ii) Date and time function
- iii) Power Management function
- iv) Reboot function
- v) Display function
- vi) Security function

### III. GAIT MECHANISM

Gait mechanism is a technology which recognizes individuals by the manner of walking. The main characteristic behind gait recognition is the person being observed without the consent of that person. A person performs his or her walking pattern in a repeatable manner. The unique feature in gait is a person can be recognized even at a long distance. In gait, the movement time patterns are considered. It is tedious to conceal the actual feature of a person.

The common parameters include:

- Kinematic parameters
- Spatial-temporal parameters
- Correlation between parameters

The gait analysis consists of several cameras fixed around a walkway which are linked to a computer. Based on the sensors used, there are three divisions. Namely,

- Motion vision based,
- Wearable sensor based
- Floor sensor based

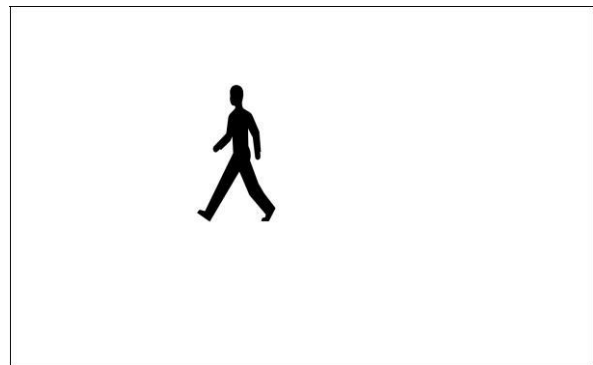


Fig.3 Sample image of gait mechanism

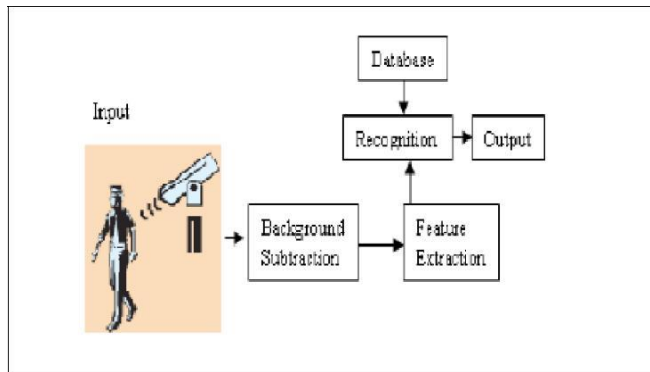


Fig.4 Block diagram of gait mechanism

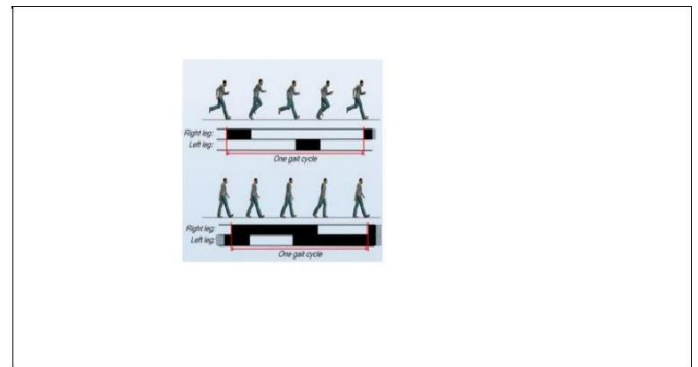


Fig.5 Diagram of gait cycle

human motion analysis. It can be divided into two categories:

- Appearance based methods
- Model based methods

The wearable and floor sensor systems are used to recognize individual at different conditions compared to the first approach. The wearable sensors enable to measure different walking styles.

Background subtraction is technique of image processing where an image foreground is extracted for processing that is to recognize the objects. It is an approach used widely for detecting moving objects. The moving objects are segregate from the background. It is consider being an important cue for human pose estimation and surveillance tracking. The main feature is the process of extracting moving objects in video frames. Feature extraction involves reduction in amount of resources which are used to describe a large data set. It is generally known as attribute reduction process. Even a complex data set can be visualized if image is reduced to two or more dimensions. It is mostly concerned about the accuracy in data. It is employed in image processing in order to solve computer vision problems like object detection and recognition. The applications are like data compression, data decomposition, projection and pattern recognition.

The device placed along the walkway captures the object through the camera and the sensed clip of the image is compared with the stored image from the database. When the two clipping matches then the actual person are recognized and individual's presence is confirmed. The web server instantly updates the details regarding presence or absence. The raspberry pi is more flexible because of its simpler design that is the connection to it from another computer through a system called secure shell.

A bipedal cycle is the sequence of movements during locomotion where one foot contacts with the ground, when that same foot contacts again with the ground. This phenomenon is called gait cycle. A single gait cycle is called as stride.

The stride has two phases:

- Stance phase
- Swing phase

The phase when the foot remains in contact with the ground is called as stance phase and the phase when the foot is not in contact with the ground is called as swing phase. Stance phase constitutes 60 percent of the gait cycle and swing phase constitutes 40 percent of gait cycle.

Gait analysis uses different types of motion sensors and systems. They are mentioned below:

- Accelerometer
- Gyroscope
- Magneto resistive sensors
- Flexible goniometer
- Electromagnetic tracking system
- Sensing fabric
- Force sensor

The gait analysis is based on the usage of different devices which capture and measure information relating to the different gait parameters. The classifications are based on: Image processing (IP), Floor sensors (FP), Wearable sensors (WS).

The image processing system is combined by digital or analog cameras along with lens to recognize the object through gait mechanism.

Techniques such as threshold filtering which converts images into black and white, the pixel count to calculate the number of light or dark pixels, or background segmentation which removes the background of the image. These are all just some of the possible ways to gather data to measure the gait variables.

In case of floor sensors, the sensors are placed on the floors. The gait phenomenon is measured based upon the pressure given on the sensors. There are two types of floor sensors: force platforms and pressure measurement systems. Both the systems quantify the pressure. The pressure management systems are useful for quantifying the pressure patterns under a foot over time. It cannot quantify the shear and horizontal components of the applied forces.

Wearable sensors are placed over the human body in places like: knees, feet, hip in order to measure different characteristics of human gait. There are variety of sensors used based on the offer able pressure range it could sustain, based on linearity, sensitivity. As mentioned above the sensors include, force sensors, accelerometers, gyroscopes, extensometers, inclinometers, active markers, electromyography, goniometer.

This wearable sensor has a good merit that all the sensors can be accumulated in to a single entity. For example, a shoe contains the integration of all the sensors like: Inertial measurement unit, flexible goniometer and pressure sensors. These are located inside the insole so that the gait analysis becomes easier when implemented.



Fig.6 Instrumented shoe: (a) inertial measurement unit; (b) goniometer; and (c) pressure sensors which are situated inside the insole.

#### IV.RASPBERRY PI WEB SERVER

The handheld device transfers all the attendance details to the local server. Raspberry Pi performs the above mentioned function. The operating system used here is RASPBIAN which is DEBIAN optimized OS and the processor frequency is 700MHZ.

ZigBee 2 module is interfaced for effective wireless long distance transmission and performance.

The details from the handheld devices are interpolated in the Excel form. The server updates the details automatically regarding the websites with the help of attendance sheets.

The reason for using Raspberry Pi is its zero noise, low power, small form factor, solid state storage. Hence, this web server is chosen.

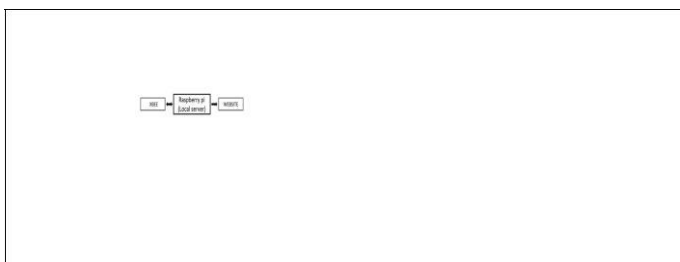


Fig.7 Block Diagram of Raspberry Pi local web server

The range selection must be carefully verified before implementing the system. Thus, field selection is more important.

XBee connects with the pc as a coordinator and the remote XBee acts as an end device. The XBee transmits the information's to the remote XBee. The attendance details are transmitted automatically because there is no scope of defaulters.

#### V.SOFTWARE COMPONENTS

A inter integrated circuit protocol (I2C) are used for the connection of chip peripherals. The SDA and SCL are the two-wire serial bidirectional buses both operates at 400kbps.The I2C protocol is acting as a interface between RTC and EEPROM. Connected device can perform as a receiver or transmitter and it has a different address. Whenever we need to access the microcontroller initiates the start condition and then it sends the address of the device. Communication starts between the devices only if the address is matched.

The IEEE standard for PAN is ZigBee which consumes low power and it is short range wireless device. The module of ZigBee works in unauthorized ISM band ( Industrial Scientific Medical).The ZigBee device supports mesh, peer-to-peer and point to point communication. The organizer, router and end device are the three major devices of ZigBee device. 16 Bit PAN ID is given to each network.

X-CTU is an XBee configuration used for configuring XBee modules from DIGI. It is also used to upgrade the on board microcontroller firmware. Using AT commands we can interact with XBee by serial-terminal.

The software part is categorized into two subparts as follows:

1. Handheld device software- used for the understanding of modules function and also the used software.
2. Local server software- used for making the local server, raspberry pi software and software used.

##### 1. Handheld Device

Programming of microcontroller is done by Atmel Studio6 Programming Software. The functions like: saving, erasing, loading and recording are controlled by attendance function and RTC (DS1307) manages date and period function simultaneously. The two functions power saving and auto power save function is implemented by power management function. In the power rescue mode, user explicitly switch device as defined by the controller. In case of power saving mode, it switches automatically if the equipment is idle for certain period. Reboot system provides reset of the system. The interaction between user and the equipment is achieved by display function. Security function manages the track of all users and only the authenticate users are allowed to access the device.

## 2. Local Server

A web server is required in order to preserve the backup of the attendance records. A server to host the website and Raspberry Pi is pre-owned for the same. Following are the steps to be followed for configuring Raspberry Pi:-

1. Configure Raspberry Pi along Debian image and supporting PUTTY like software.
2. Allows SSH connections.
3. Change host name.
4. Use SSH login.
5. Change the default password.
6. Install Apache with PHP and MYSQL.
7. FTP server installation.
8. Installing PHP MYAdmin.

Raspberry Pi becomes ready after performing the above mentioned steps in a sequence. Raspberry Pi becomes portable whenever ZigBee gets connected with it. Finally, a website hosts with full attendance records.

The web server connects with the institution's server and receives the updated details of attendance of the concerned institution in a regular manner. The attendance information is represented in the form of Excel spreadsheet which is generated by Raspberry Pi server. MYSQL database is the type of relational database management system (RDBMS) which is an open source bibliography management system. This provides the tabulation form representation for the attendance details. Whereas other database management system represents data in the form of file storage. Hence, RDBMS is preferred for the attendance detail information.

The admin and faculties enter the details with the help of database connectivity through the user interfaces in the network pages. The website is divided as partitions like as follows: a) Students, b) Teachers, c) Admin and d) Head of

Department (HOD). Admin issues the Id's and passwords to individual students for verifying the details regarding the attendance. In the students portal only the students have the rights to monitor their details. If there is need for amendment, then faculties have the rights to modify if required in the teachers login. HOD's are provided with full accessibility relating to the individual attendance of the student.

## VI.CONCLUSION

This Gait recognition system overcomes the conventional approach by monitoring human without their cooperation.

The system manages attendance details of a group of students of the institution and maintains a periodic backup of the details for future reference. This ensures effective attendance management in schools, colleges and organizations where there is several numbers of pupil, staff, and employee. Thus, traditional approach of attendance taking and compiling is tedious and thus replacing it with the modern approach makes the attendance process simple and ensures more effective implementation. This also employs applications in military

domain to track the presence of terrorist in the particular locality, detection of theft in places where people roams more.

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