Smart Belt using Microcontroller

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Abstract---Smart Belt is the type of wrist band which incorporates wireless communication. The device can send signals to a Wi-Fi router when registered on that network. The main aim is to monitor whether the Smart-belt is in the wireless range or not. This kind of setting is preferably for offices where such devices can be used to keep the log of the employees that is their arrival time, departure time and the time when they were out of wireless range. An android application may be used to monitor all the functions of the Smart-belt.

I. INTRODUCTION

Microcontroller today has become a very popular communication tool among communication devices. Smart Belt is designed to overcome the limitations of basic employee monitoring systems. Employee monitoring systems are those which keep records of the employee's attendance, their check-in and check-out timings or they can be monitored with the help of live cameras in the work environment. These cameras can give live feeds of the employee's current activities, but it becomes difficult to keep an eye on all the employees at once. To solve this problem, Smart-Belt is designed. It can give real-time updates of the employee, it can notify if any of the employee is out of range, log the check-in and check-out time on its own and can also calculate total hours worked for a particular month. The connection of the Smart Belt is done with an android device which has an application installed which does all the calculations.

Maintaining a daily job card of the employee is a very old tradition way of keeping records for the employees. It is time consuming and tedious task to practically maintain every employee's card who is working in the organization on daily basis. Tallying records of each employee manually was again a hectic job. Also, people by their influence could mark the bogus attendance of their friends which would be hard to detect by the organization.

New technologies such as retina scanning and fingerprint scanning are used these days.

Fingerprint scanners for employee attendance system are common examples of maintaining the attendance of employees, but the problem here is that due to few scanners present at the organization and all the employee have same reporting time, the problem is that all of them cannot register at once. They have to maintain a queue resulting that if 100 employees enter the company together and say only 5 scanners present, the log in time of them in the queue would have a major difference, some of them may even be late marked even though they have entered together. Also, in hurry it is possible that the employee may forget scan and enter the office which would mark him/her absent.

The idea of this project came from the drawbacks of other employee attendance system. None of the technologies used to log details of the employees provide a real-time monitoring of the employee. Hence the idea of developing Smart-belt evolved. The belt will keep a track of the employee's regular attendance as well as it will be helpful for real-time monitoring. To stop these malpractices we have come up to this idea to preparing the Smart Belt which would keep a track of the employees.

This smart belt application is developed for a working organization. It will keep a track of all the employees working in the organization and generate a tally sheet of attendance at the end of the month. This will reduce the manual work of tallying the attendance at every month end .

This project emphasises on keeping a track of the unwanted breaks which are taken by the employees for stupid reason including faging and washroom breaks.

In organization or workplace many times employee may leave the workplace for short or long time without knowledge of organization. Employee may give the bogus attendance in organization and leave immediately without knowledge of anyone. Due to this it is not possible for organization to keep track of employees that what they are doing or they are present in work place or not!

Employees monitoring problems can wreak havoc in your workplace. It breaks down communication, creates tension and reduces productivity. Handling employee monitoring problems properly will help you avoid these issues and lead your team effectively.

This can be achieved by smart belt using microcontroller. Smart belt is a hardware device made up of microcontroller and Wi-Fi module. It is designed in such a way that employee can able to wear it in wrist like watch. Android application is developed to keep track of device and can able to communicate with smart belt.

II. RELATED WORKS

Traditional employee monitoring systems were nothing but just used to maintain the employees log about their attendance. A register was maintained and each employee personally had to sign their arrival time and departure time. A security official had to monitor the register so a track record of each employee could be maintained.

Later, job cards/punch cards were issued to each employee. Each one of them had to personally get the stamp or sign of the security official to mark their arrival and departure time. The overall working hours in a month of the employees were calculated on the basis of the attendance.

The above mentioned two monitoring systems had major flaws. The security official can be bribed to mark fake attendance or the official can mark his friends attendance as well.

As technology evolved, security systems such as fingerprint scanner, retina scanner were developed. Fingerprint scanners require each employee to scan their thumb or a finger at their arrival time and again they have to

scan the same while departing. The employee to scanner ratio may lead in inappropriate marking of individual's attendance. Retina scanners are not feasible for small organizations as they are not cheap. Big corporate organizations may use them for top officials. But the problem here is that once the employee logs in, is he/she really inside the working premises cannot be determined.

Nowadays video surveillance is also used. Video surveillance may require an extra official to monitor all the employee and some employees may take the advantage of camera placing and work accordingly.

None of these systems provide real-time feedback monitoring, but all of them provide security up to a level to provide real time feedback monitoring we came up with the idea of smart belt using microcontroller.

To develop a smart belt we need a microcontroller which has Wi-Fi module integrated in it. As there are many microcontrollers are available in the market which has Wi-Fi module integrated in it, we need to select one which is best suitable for belt in terms of size of microcontroller, cost of microcontroller and specification which we require for smart belt.

There are four microcontrollers which we have short listed for the smart belt. Their comparison is showed in the table below:

Sr. No	Parameters	Arduino Yun	Wasp mote	Spark Core	Electric imp
1	Microcontroller	ATmega32u4	ATmega1281	STM32F103	STM32F103
2	Analog I/O	12	7	8	6
3	Digital I/O	20	8	8	6
4	Range	N/A	160/900 ft	100-300 ft	250-300 ft
5	Frequency	2.4 GHz	2.4 GHz	2.4 GHz	2.4 GHz
6	Wi-Fi Standard	IEEE 802.11b/g/n	IEEE 802.11b/g/n	IEEE 802.11b/g	IEEE 802.11b/g/n
7	Operating Voltage	3.3 V	3..3 - 4.2 V	3.3 V	3.3 V
8	Cost	$ 74.08	N/A	$ 39	$ 43
9	Criteria for Acceptance/Rejection	Rejected due to cost and availability issues.	Rejected as it is not available as a consumer product.	Rejected due to long waiting period	Accepted as easy to use and set up.

Fig. 1: Four microcontroller

III. PROPOSED MODEL

Smart Belt is designed to overcome the limitations of basic employee monitoring systems. Employee monitoring systems are those which keep records of the employee's attendance, their check-in and check-out timings or they can be monitored with the help of live cameras in the work environment. These cameras can give live feeds of the employee's current activities, but it becomes difficult to keep an eye on all the employees at once. To solve this problem, Smart-Belt is designed. It can give real-time updates of the employee, it can notify if any of the employee is out of range, log the check-in and check-out time on its own and can also calculate total hours worked for a particular month. The connection of the Smart Belt is done with an android device which has an application installed which does all the calculations.

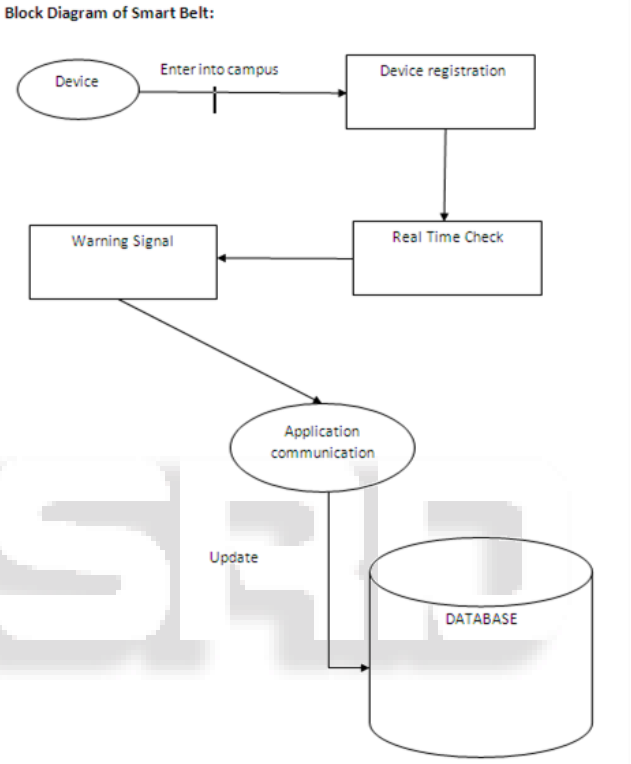

Fig. 2: Block diagram of smart belt.

A. Device

It is a hardware module which consists of microcontroller called as smart belt. Smart belt is wear by employee in their wrist. It is designed in such a way that it is easy to use. Microcontroller is programmed so that it can able to communicate with application. Each smart belt has its unique identification number by which they can be identified**.**

B. Device Registration

When device enter into campus (range of communication) it is automatically registered into database. Automatic registration of device is done through continuous scanning of device. If device is in the range of communication then its unique identification number is checked and all the information like log in etc. are stored.

C. Real Time Check

After device has been successfully registered in database, continuous scanning of device is done so as to check whether device is in the communication range or not.

D. Warning Signal

If the device gets out of communication area than warning signal is generated and send to both device and application which handle database. Warning signal is used to indicate that device is out of range and not able to communicate.

E. Application Communication

Android application is created to maintain the database and device communication. Android application can send signal to the device when it is out of communication range and also can able to view employee information.

F. Database

Database is used to maintain the information about employee. In database information like name of employee, unique device identification number, in time , out time etc are stored.

G. Feasibility Study

The very first phase in any system developing life cycle is preliminary investigation. The feasibility study is a major part of this phase. A measure of how beneficial or practical the development of any project would be to the organization is the feasibility study.

The feasibility of the development smart belt can be studied in terms of the following aspects:

1) Operational Feasibility:

The belt will reduce the time consumed to manually log their records. It is tiresome and cumbersome to maintain the records. Hence operational feasibility is assured.

2) Technical Feasibility:

Minimum hardware requirements:

For Device

- Android OS. (4.0 ICS or higher)
- At least 256 MB RAM.
- Wi-fi a/b/g/n.
- At least 10 MB free memory space.

For Belt

- Electric Imp
- Electric Imp breakout board
- Active Internet connection
- 3.3V Battery

3) Economical feasibility:

Once the hardware and software requirements get fulfilled, there is no need for the user of our system to spend for any additional overhead.

- The belt will reduce a lot of paper work. Hence the cost will be reduced.
- The belt will reduce the time that is wasted in manual processes.
- The storage and handling problems of the registers (logs) will be solved.

4) Motivational Feasibility:

The users of the belt do not have to wait in long queues for logging.

5) Legal Feasibility:

The licensed copy of the required belt is quite cheap and easy to get. So from legal point of view the proposed system is legally feasible.

H. Design

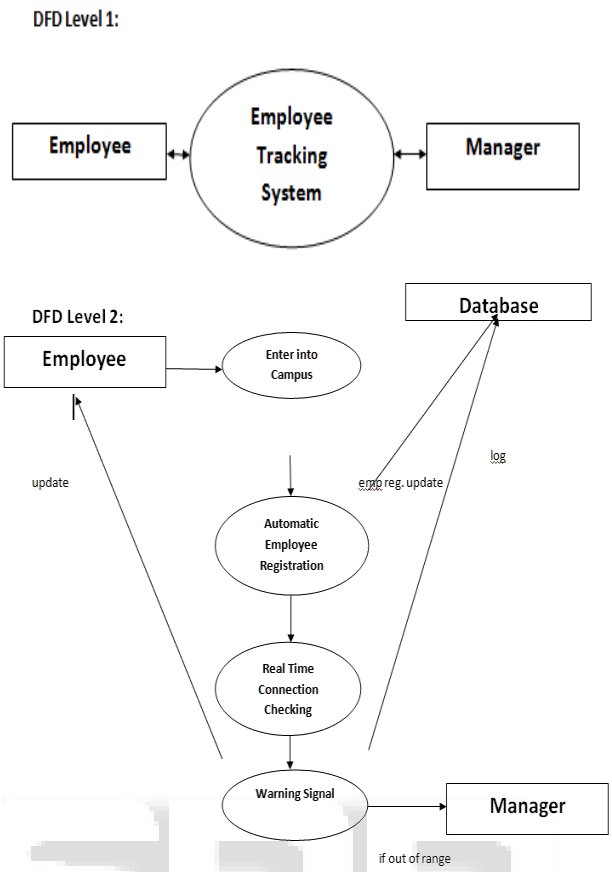

Fig. 3: Two levels of data flow diagram.

The figure 3 shows the two levels of the data flow diagram. The figure represents the detailing of the smart belt in each level.

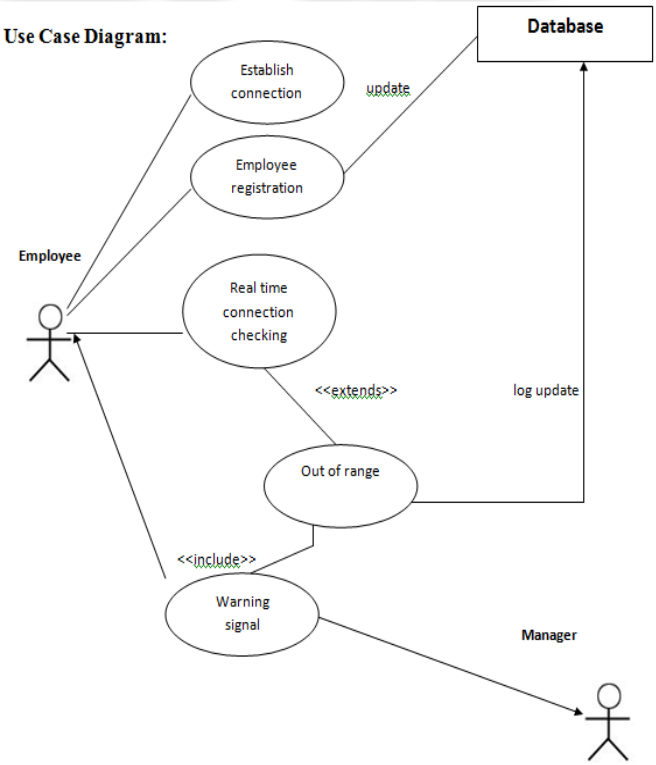

Fig. 4: Use Case diagram.

The figure 4 represents the Use Case diagram of the smart belt. It shows a typical use case scenario of the smart belt and it's working.

IV. CONCLUSION

Employee monitoring and tracking systems are one of the important areas so as the organizations can work efficiently. Monitoring of the employees can result in indirect growth of the company. As employees are monitored, they have an overhead pressure that they are under surveillance and they need to deliver. Smart belt is one such device that helps real-time monitoring and serves the purpose. For increased security, Smart Belt can be used with spy cameras so along with real-time connectivity, we can have real-time video feedback as well.

The future work to enhance the capabilities of the belt would be to develop a locking system so on the removal of the belt, warning signal is sent to the monitoring device. Another improvement in the field would be to enhance the range of connectivity's by adding range extenders and improve support for multiple devices.

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