Strengthening People Analytics through Wearable IOT Device for Real-Time Data Collection

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***Abstract*—The organizations are evolving through technological advancements and building a novel tech- culture by implementing the People Analytics, Machine Learning, IOT and Artificial Intelligence. The digitalization of both structured and unstructured data has helped organizations to predict future events across all the functional areas, mainly – Marketing, Operations, Finance, Productions, and Human resource management. People analytics is leveraging the Internet of Things (IoT) for improving business decisions related to acquisition, motivation, utilization, and retention of talented employees in the organizations. This paper attempts to study how organizations are leveraging technology and tools to radically transform the way HR and business leaders are using people data. In this paper, we have discussed a framework for real-time data analysis with the help of wearable IoT devices. We have considered wearable IOT technology supported wristband which will be enabled with movement sensors, GPS, accelerometer, heart rate related sensor, thermometer sensor for real time data collection. These sensors continuously collect data and can send to the nearby designed system as per the communication network. This data can give much-hidden insight about an employee. The paper suggests a model for the Human Resource Management system through wearable IoT device to provide unbiased and transparent results.**

Keywords*—People Analytics, IoT, Sensors, Communication Network, Workforce, Human resource management.

I. INTRODUCTION

The technological influences are reforming the processes and redefining the systems. The Internet of Things (IoT) technology is one of the major players to reform the industries. The one main system in all the industries is the Human resource that is also potentially affected and re-formed due to the IoT. The internet of things is a convenience and analysis in decision making and making secure investments for the company. The IoT and number of devices both are growing together with the sensors leading to the growth maximum dependencies on the IoT enables decision making. The recruitment, section, document verification etc. can be easily done through the help of technologies to equip the HR department. IoT will be enhancing better recruitment, measuring employee attitude and behavior to produce a quantifiable work and accurate insight of who has done it [1]. The IoT and analytics market will reach $ 520 billion in the year 2021 at compound annual growth rate of 20% (2017-201). System integration and Data Center & Analytics segment are predicted for maximum growth. Fig.1 [2] .

Over the years technologies like Artificial Intelligence, Machine Learning and People Analytics have brought a huge transformation in Human resources management practices throughout the world. Technology has reformed the way companies acquire, manage and engage their employees.

People Analytics helps HR managers to utilize the big employee data to make decisions related to various HR functions. Artificial Intelligence (AI) breaks down and convert data into a format that is easy to interpret; Machine Learning (ML), which is a progressive form of AI scans data to identify patterns and adjusts Programme actions accordingly [1].

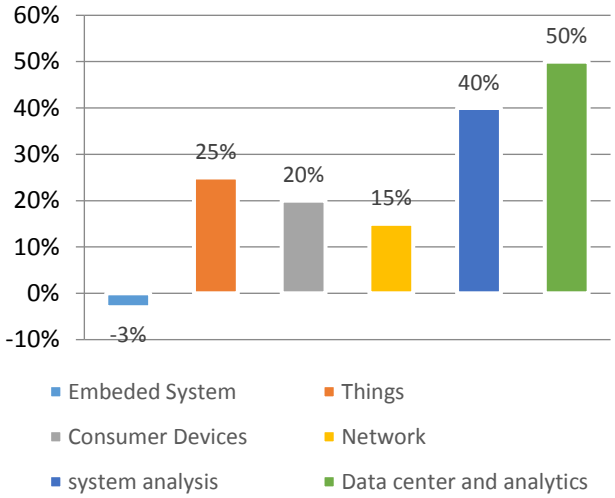

Fig.1. Growth of IOT and Analytics

The graph depicts the growth of IoT in system integration, network, consumer devices, things and data center analytics with embedded systems. [2] The maximum usage lies on the analytics and data center enabling the decisions through machines. People Analytics and Artificial Intelligence utilize historical records and algorithms for future decision making, thus assisting HR leaders to develop strategies using smart data. The predictions made with the help of digital tools generate suitable data to help HR practitioners improve workplace learning, reduce biases in candidate assessment and retain and motivate existing employees, thereby creating an employee-oriented corporate culture [3].

The McKinsey Research Institute's January 2017 report, [3] stated that technologies such as AI and robotics are drivers of economic growth and prosperity. The global economy's productivity can be increased by 0.8 to 1.4 percent annually on the assumption of automation replaces human labor. According to McKinsey IOT market will reach $ 581 billion by 2020. [4] This reflects a very strong adoption of IOT technology and devices in various domain of organizations.

II. MOTIVATION AND CHALLENGES

Wearable devices can are track everything based on sensors on devices and through which the process will fetch the right data at right time without stressing too much. It will ease the identification, security, location tracing, health and fitness of the employees with the smooth operation of cloud and data collection and without the interference from the HR. This will not only smoothen the process though will be able to reduce the cost to the company. The best part is the monitoring and widening the range of information that will help the business to be smoother and accountable. The IoT wearables may fetch the smallest form of data like the voice modulation stress level and sentiments etc. can also be monitored.

The Challenge with wearables is that the employees will have the feel of being observed and traced that could be an issue for few. Whereas, the biases approaches and favoritism can be avoided through the clear cut machine data collection. Moreover, the wearable's can be destroyed and tampered at times that could need a parallel system to be developed as well. There are several wearables are utilized in a different setting of Human resource of the company as the wearables. The overdependence on technology may collapse the entire system in the case of any error and the leakage of information will remain a major concern.

III. REVIEW OF LITERATURE

The field of Human Resource Management was widely explored in the writings of Peter Drucker since the 1950s. Although it was only during the mid-1980s that HRM was recognized as an important field of study (Beer, 2015; Kaufman, 2015; Marciano, 1995) [5], [6], [7]. In 1990s organizations started considering employees as an important resource to get a competitive edge in the market (Ulrich, 1997[8]; Barney & Wright, 1998[9]; Pfeffer, 1994 [10]; Ulrich & Lake, 1990 [11]; Huselid, 1995 [12]; Wright, Dunford, & Snell, 2001[13]). In the following years, new techniques were developed to calculate return on intellectual and human capital (Fitz-Enz, 2000[14]; Bontis& Fitz-Enz, 2002[15]).

To evaluate the efficiency of HR practices, the tools like HR scorecard was developed in early 2000 (Huselid, Becker & Beatty, 2005 [16]; Ulrich & Beatty, 2001 [17]). During mid 2000 researchers analyzed the need for evidence-based approaches to Human resource management (Pfeffer & Sutton, 2006[18]; Boudreau & Ramstad, 2007 [19]; Rynes, Giluk & Brown, 2007 [20]) and People Analytics was discussed in many HR Journals including Harvard Business Review (like Feather, 2007 [21]; Levenson, 2005, 2011 [22, 23]; Fink, 2010 [24]; Waber, 2013 [25]).

Although it was only recently that People Analytics gained more popularity (Rasmussen & Ulrich, 2015 [26]; Ulrich & Dulebohn, 2015 [27] and has been evaluated as "Predictive Analytics" which is used to identify past patterns to predict future events (Van Den Heuvel & Bondarouk, 2016 [28]; Fitz-Enz & John Mattox, 2014 [29]). Organizations have been collecting data on their customers from a long time, to gain insights to predict future behavior. The analyst is using the Big Data to make decisions (Angrave et al., 2016[30]; Shah, Irani & Sharif, 2016 [31]).

Organizations are using the Internet of Things (IoT) to collect and measure meaningful data to enhance business performance so as to compete and sustain in the vibrant digital economy. IOT is used in People Analytics to access the effectiveness of HR practices and improve employee productivity. [32] [33]

A. Different Levels of Data Analytics

There are four levels of data analytics used by organizations to extract knowledge from people's data and improve their business outcomes: [34].

Descriptive Analytics:

It reveals what happened or is happening now based on input data. This type of analytics is mostly used for research purposes. For e.g. it is used in sales to classify customers according to their product preferences and sales cycle.

Diagnostic Analytics

It studies past data presented by descriptive analytics to determine the causes of events, what happened and why it happened. For example, Marketing campaigns are analyzed to understand what worked in earlier campaigns and what did not work.

Predictive Analytics:

It studies past data to predict future events. It can be used in sales and marketing to study customer data to shape the entire sales process or can forecast which employee is likely to resign within the next 60 days based on employee data. Predictive Analytics makes use of artificial learning and Machine learning to forecast future events.

Prescriptive Analytics:

It studies data to identify actions to be taken – for decision making purpose. These decisions are unbiased and more reliable as they are based on real time employee data. For example, prescriptive analytics can suggest a training program for the employees whose productivity is likely to decline, so that their performance can be managed, reducing employee turnover.

B. Role of IOT in Human Resource Management

IOT has helped organizations to introduce open workspaces and flexible work-schedules for their employees. This mobile workforce can work on projects, conduct meetings and exchange information with their employers at any time and location, thereby enabling real-time monitoring of employees by the employer. [35][36].

IOT is used by Human Resource Managers to achieve operational excellence in various HR functions:

Improve Employee Productivity:

IOT enabled sensing devices can be attached to employees and to all the equipment used by employees to

record every aspect of employee experience in the organization. This will enable decision makers to make better decisions to improve employee productivity. This will help reduce human error as the decisions are made on employee data rather on manager's intuition. [37]

Employee Health:

Stress, less physical movement, junk food are all related to many health problems like diabetes, obesity and heart problems. Employers can keep track of employee fitness by giving them fitness trackers. This will also help the employers to design wellness programs for their employees to improve their health and productivity levels. [35] [37]

Talent Acquisition and Onboarding:

Majority of organizations are using IOT tools for the recruitment of human resources to eliminate perceptual biases. IOT has optimized every stage of the recruitment process thereby drastically increasing the quality of hiring decisions. Candidates can be placed in a virtual situation at the time of interview to analyze their behavior and reduce biases in decision-making. [35] [38]

Performance Management:

Organizations can use the data accumulated by IOT tools to develop a closer bond with the employees and empower employees. HR managers use analytics to set concrete objectives for the employees. This makes it easier to control and generates better overall results thereby increasing the productivity level of employees. [35]

Succession Planning:

IOT uses personal and work-related information of an employee to rate them across various dimensions for the purpose of succession planning. This will enable the managers to get hands-on information on the employees who will be ready for promotions, in the next six months or a year. [38]

Training & Development:

IOT can help to personalize corporate training programs for employees. HR managers can plan, organize and coordinate a training program for all employees by capturing meaningful data related to performance appraisal of employees. [39]

Payroll Management:

IOT tools can also help HR managers with payroll and expenses. Employees are now not required to fill forms for documenting transportation expenses, rather they can inform the HR using mobile technology and it will inform the HR manager to get the approvals done from the manager. [38] [37]

Some of the *Big Data Analytics* platforms used by HR managers to manage employee data generated by IOT are:

Apache Hadoop:

It is a data processing platform that was first used by Facebook and Yahoo! to store and process big data.

1010 data:

This tool helps in optimization and analytical analysis of IoT data and is useful for companies having a large infrastructure.

Cloudera Data hub:

This tool processes and analyses a huge amount of IOT data from organizations but do not have its own hardware and software system.

SAP Hana:

This tool can analyze unstructured data although it is not as effective as other solutions.

MapR:

More complex in comparison to Hadoop. This tool enables predictive analytics, fast processing and build in system recovery approach. [40]

PeopleInsight:

This tool helps the organizations to pool all the data together for analysis, to get customized results. [41]

Crunch:

This software empowers HR managers to identify competency gaps and appropriately plan talent acquisition and development.

Aurion Analytics:

Aurion aids in the visual representation of the analyzed data in form of tables and graphs.

Advanced Systems:

Its BI tool uses employee data to give real-time feedback to HR managers. This tool is mainly used in retail, healthcare and hospitality industry.

Talentsoft Analytics:

This software with its user-friendly features gives real-time feedback on KPIs for appropriate decision making.

BambooHR:

Customizable software to make HR more proactive. [41]

C. IOT adoption for HRM/people analytics, and growth

The technology is adopted widely as per the data stated and the people analytics is getting to be dependent on the technology soon. The Human resources of a company are very big domain to be monitored without the biases and loopholes and the IoT enabled wearables may be the best way to overcome the issues. Currently, many companies have started the implementation of technology in various areas of work. The major functions are Identification, Health, Fitness, Location Tracking, In-cloud data storage, Data analytics, Money Transactions, and Telecommunication.

The identification can be done through multiple ways like Biometrics, Fingerprint, smart card etc. the companies such as Precise Biometrics have started manufacturing devices. The Fitbit watches can provide the heart rate and perspiration level to track the health and fitness of the employee. GPS and Navigation is widely used and known technology for location tracking. Fig.2 represents a forecast of worldwide adoption of wearable IOT technology. Which represents upcoming market of wristband and watch, which is also a reason we have proposed an IOT enabled wearable for real time data collection. Similarly, the money transactions through the payment wallets are made possible by the wearable devices companies like bpaywristband. Another company like Vivametrica has utilized the

technology of Population-based algorithm and Cloud Computing to get data analytics. The advancing demand and upcoming companies showcase the utmost requirements and demand of the wearables.[42].

These tools provide dynamic solutions to employee problems by providing actionable insights on people practices, programs, and processes in the organization. Proposed Model for the comprehensive implementation of IOT in Human Resource Management.

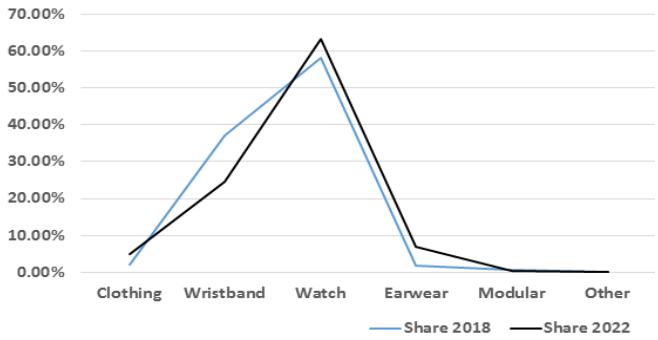

Fig.2. Worldwide wearable forecast 2022 [43]

The basic functions of the Human resource department are multiple and differ with the size, location, and nature of the business. Important data from each of this department can be collected in real time from an employee with the help of IOT enabled wearable band. The basic functions are segregated under a few headings to collate as stated in Fig.3.

Fig. 3. Connectivity with IOT band with Basic Functions of HRM department

The illustration depicts the major eight responsibilities of the HR department in any organization from the talent requisition to performance appraisal and the legal policies. Whereas the employee engagement begins from the hiring, training and leads to retention of the build assets. At the same time the record management and payroll, benefits as well continuously add on to the responsibilities. The spectrum of any HR department grows in all direction all year round and while acquiring the new skills set the old needs to be enhanced or truncated to ensure the vital growth and development of employees and organization. At each stage, data can be collected.

There are various functions of the human resource management which can be broadly summed up as under.

1. Talent Acquisition
2. Employee Engagement
3. Training & Development
4. Performance Management
5. Payroll Management
6. Employee Retention
7. Benefits and Policy Development
8. Law Compliance

The talent acquisition that is the set of multiple activities performed by the Human resource department such as job role identification, defining the eligibility criteria, advertising the vacancy or contacting the consultants. After the successful operation of all these processes once candidates apply their scrutiny, interviewing and recording of data will be done. The next fruitful result of these processes will initiate another process of hiring later promotions and reassignments. The HR will keep complimenting the employee's learning through the training and development which itself a combination of multiple processes such as training program requirement identification, development, selection of appropriate set of employees for the trainings and evaluations. The performance management is another major role of the HR in which salary determination, performance appraisal, review, processing and awarding etc. Moreover the payroll and the benefits to employee is also one of the vital task that include bank account, leave calculation, overtime bonus etc. and benefits like visa, insurance, visa and policy formulations for benefits. After all this the employee either stays long or short in the organization leading another responsibility of HR i.e. retention of the employee and compliance with the local laws. These responsibilities are again a set of multiple complex process like company / employee legal dispute handling personnel data entry, records maintenance, consultation and advisory services to employee or management.

Realizing the overall functions and acute importance of the Human resource department in the organization, the paper has developed a model to support the digital growth leading to the advancement and ripe the benefits of IoT. The performance management will be a more systematic and unbiased based on the results not on the biased evaluations.

IV. Model for IoT Enabled wearable Band

Our paper presents a framework of automated real-time data collection of an employee. Knowing more about the employee is always an asset for any organization. There is always a lot of data available about an employee but the HRM system fails to capture as they are not technological designed in that way. Real-time data about an employee may be related to employee health, employee time management, where the employee is investing organizational time more; these all data can be very useful for the Human resource department. Our paper presents the concept of wearable IOT device (wrist band) which will be activated in office premises. Activation of wearable IOT band will be only after an employee is able to successful login with his/her biometric in the organizational network. At the same time when an employee logs off his/her biometric, the wearable device will not function. Fig.4 represents the conceptula framework of proposed model.

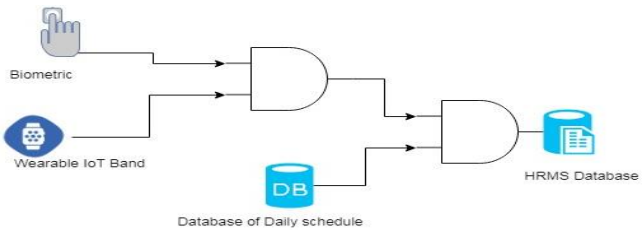

Fig.4. Framework for real-time data collection

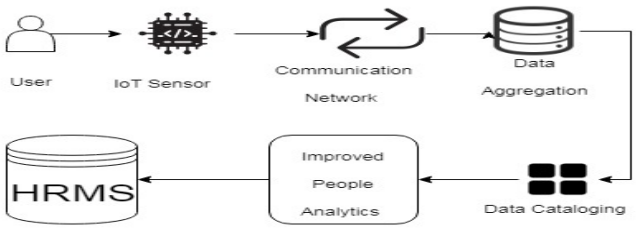

Fig.6. Process of data Collection with IOT sensors

Once wearable IOT band is activated data can be accessed with the help of current location/ scheduled meeting or work. And this data can easily be transmitted to nearby access points, later on, the same data can be recorded in the database. Even the same wearable IOT band can help to understand more about employee health. Because more number of fit and healthy employee's is a direct reflection of healthy organizational**.** So this wearable IOT band will not only help to know where the employee is but it will also help to know how they are. Location based data can have a privacy challenge, which needs to be implemented with employee consent.

A. IOT Technology Stack

IOT stack (Fig.5) is a set of related technology which together makes this possible to collect data with the help of IOT enabled devices. Sensor layer which enabled data sensing and this coordinates with next layer which is a local connected HUB (computer, data center, mobile) as configured. Which in turn communicates this data to network followed by which is stored in the cloud or in the local database.

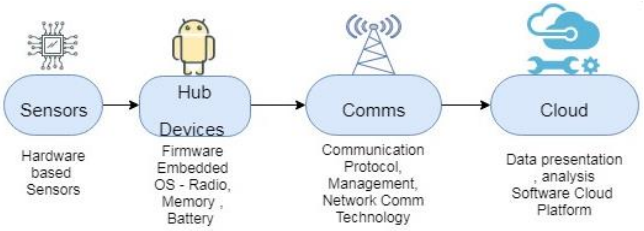

Fig.5. Segments of IOT stacks

B. The process of Data Collection

In organization when employees are around with wearable IOT bands which are enabled with different sensors like location-based, heart rate monitoring, thermosensor for sensing body heat of employee. This can lead to real-time decision. The temperature of a location in an organization can be managed as per employee sensor data collected. Data can be continuously collected with sensors which are then transmitted via organization network. Further same data can be sent for data aggregation. Data aggregation helps to represent collected data in a summary format and which is primarily used for some statistical analysis. After which the entire data is divided and stored in the proper related data catalog. Data cataloging helps to arrange entire data with proper and in a related local database or in the cloud, where the maximum use to data can be ensured. This, in turn, helps HRMS for better and suitable People Analytics. Following figure (Fig.6) explains this process of data collection with the help of wearable IOT based band, which are equipped with sensors.

C. Example – Improved People Analytics

The Fig.7 explains a hypothetical scenario of an organization where employee's entire day time management can be tracked. With the help of a location sensor, it is easy to know where the maximum time of an employee is spent. Or how many time people have taken a break. From this, it is also very easy to know, which the task in which employee is comfortable and which are the teams with which person can work comfortably. In short, this can generate employee behavioral based data. This can also provide data about a meetings/scheduled taks attended/unattended, time spends in the waiting room or in the pantry. This can be customized as per organizational privacy policy and employee comfort. Each section of office equipped with WIFI and data can be transmitted from sensors to near-by nodes and which can be cross-checked with already task management for the employee at that time. These sensors can be modified to capture voice data from the configured location. (In the Fig. 7 office location is defined in numbers, which are used as 1 for Managers Cabin, 2 for waiting area, 3 for an office desk, 4 for back end support, 5 for meeting room, 6 for Pantry).

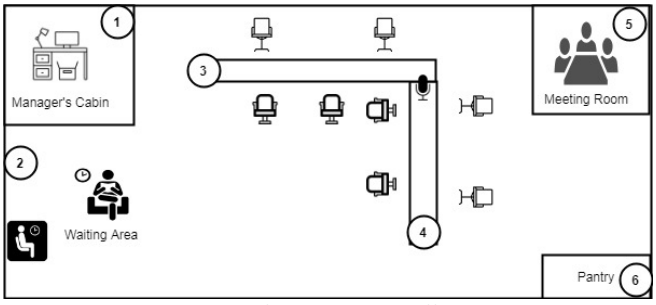

Fig.7. Hypothetical scenario of an organization office space

V. CONCLUSION

IOT is a step forward to all the organizations who are digitalized or willing to be digital soon. One of the major issues which needs to be address is privacy and ethical issue where employee can debate not to get agree to provide data from various location which may be pantry or waiting area. This kind of issue need to be address carefully before implementing technology and should be implemented with employee's consent. Second challenge can be how to ensure that wearable device is used by authorized user for the entire day. As at the time of login employee biometric will be captured and till the time of log out this can be ensure with the help of OTP (On time password) system over employee mobile phone or over the email. The core of each organization HR department is also prone to move towards a more proactive analysis of employee data to utilize the benefits of big data, for effective people management and perfect decision-making organizations should train their

employees to work with advanced technologies. Furthermore, new job roles should be defined and cross-functional teams should work together to develop new business solutions. Aversion towards digital HR can hamper the growth of an organization. Therefore, it is important that industries should equip themselves for the adoption of IoT as this will help to improve employee relations, reduce turnover and build better HR solutions for the organizations.

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