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Revolution through Embedded Systems with Data Analytics

Dhatri Raval, Jaimin N Undavia

Abstract: ***Emerging theory of Embedded System, Internet-of-Things, Data Analytics and Artificial Intelligence open up broad spectrum to develop innovative applications and to make existing system more efficient. Advent of this new technology speeds up the race towards the automation in eavery aspects of human life. This paper provides a study of embedded system, microcontroller and sensors which can be used for developing such applications. With this study, survey of vital tools and technologies is also discussed and proposed for the development of IOT based application. Paper also provides a model to gather the data from an industrial plant on which data analytics can be done. This paper shows a wide range of IOT perspective for the design of embedded system by discussing research done in it and to use that theory to develop a product which can be helpful in society for the welfares of human kind.***

Keywords: Embedded System, Iot, Data Analytics

I. INTRODUCTION

In embedded system, combination of electronic system, computer hardware and a software is used. The electronic system is an intermediate betweern the computer hardware and software. The computer software is embedded on computer hardware and electronic system works as controller between them. The entire essembly can either be programmable or non-programmable which basically depending upon its proposed applications. The embedded system is basis for the current buzzword Internet of Things and motivated the entire world to go for automation in almost each aspects of human life. This innovation has put the world at the stage of huge revolution through its amzing applications. The basic definition of emebedded system states that it is a way or working, organizing, performing single or multiple task as per defined by the set of rules. The set of rules is nothing but the program written for a particular system which makes all the units to assemble and work togather. Embedded system has versatile range of its applications which ranges from household domestic peripherals to some vital defense veapons too. Medical, genetics, manufacturing, entertainment, visualization, space science, bio informativs, etc are the recent fields which have started advent use of the embedded system for the betterment in their routine activities.

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These embedded systems either microcontroller or microprocessor based so as we can achieve it functionality with full extent.

Some latent advantages of emebedded system make them more attractive to alomost any fields. The knowledge is starvated from huge amount of data and such automated systems are proving themselves extremely important and efficient in data collection.

Once the system is installed, it can collect and tranmit huge amount of vital data for the future use, which is ultimately data analytics and analysis.

The speed, size, power, reliability, accuracy, adopatability of embedded system makes them more popular and handy for motivation of use. The speed and accuracy make them suitable for high preceision task carried out in clinical and defence domain. The compact size make them suitable to support smartness in handheld and mobile devices. The less power consumption is an added advantage of this intelligent system.

In this paper, we have approached with the basiscs of embedded system and its proposed inclination with the huge term Data analytics.

II. EMBEDDED SYSTEM

Embedded systems are a basis of the electronics industry. Embedded systems are designed for a specific purpose.

Embedded system is device which iscombination of hardware and software.Based on the system it requires microprocessor or microcontroller.Mainly embedded system is classified in two major fractions.

A. Based on performance and functional

Requirements.

Based on performance and functional requirements which additionally categorized into four types like real time, standalone, network and mobile. Time or deadline based system, digital camera, wireless MP3 are example of performance and functional based embedded system.

B. Based on performance of microcontroller

Based on performance of micro controller it can be categorized in three types called small scale, medium scale and sophisticated embedded system. Controller, temperature measurement system, ATM etc. are example of microcontroller.

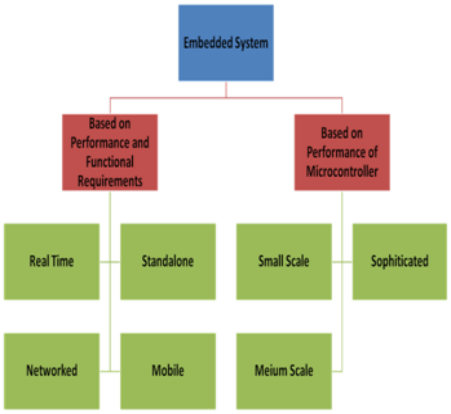

Fig. 1

Derived from above embedded system user can produce some raw data, but not able to take any decision based on that raw data.So in order to make this system more decisive, some data analytics techniques are applied to derive a meaningfull insight out of these data.

Challenges of embedded system

To work with embedded system, user may require different expertise with more reciprocal approach towards the development of the system. Development of embedded system is not as simple and straightforward as traditional computer software system. For example, testing ofembedded system requires all different way of implementation than simple software based computer system**.**

Moreover, security concerns are more critical in such systems and more secure algorithms must be used to provide full proof security to the developed embedded system.

III. DATA ANALYTICS

Data analytics is scientific way to analyze the data and produce the robust data. Data analytics is classified into four different types.

A. Descriptive Analytics

Descriptive analytics is statistical summarization of raw data. It is generally used to perceive specific pattern from the past data. It forms the pattern for better prospects and new decision making policies.

B. Diagnostic Analytics

Diagnostic analytics is used to get preciese insights of given problem. It provides the root couse of the problem with its detailed explanation.

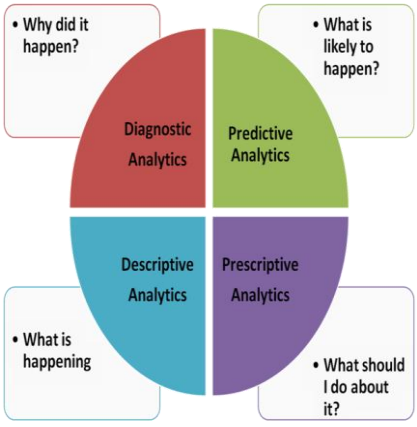

Fig 2

C. Predictive Analytics

Predictive analytics provide speculation based on the available data. This analytics is used to predict accurate time of event to occur. All predictive models are based on this predictive analytics.

D. Perspective Analytics

Persepctive analytics is used to show the best possible action from the available different possibilities.

IV. ANALYTICS DRIVEN EMBDDED SYSTEM – APPLICATION AREA

Embedded system can produce massive amount of data. These produced data can be proved vital for the betterment of any organization because with the help of these data, one can develop intelligent product or product service.

By using analytics user can describe and predict the performance ofgiven system.These analytics can also be used to automate the procedures ad decisions.

Data analytics for embedded system is well explained by the figure 3. A trained model is available for embedded system which produces some meaningful data. It starts when data loaded into that system and after that

It starts once data load in system. Apply some preprocessing and algorithm on data then will develop trained model. The same process which applied for traind model also apply on predicted model by adding the prediction.

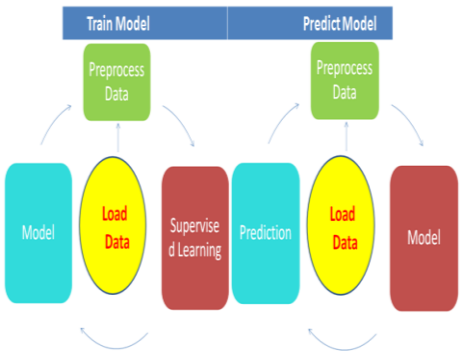

Fig 3

V. LITERATURE SURVEY

"Anand Nayyar, Ranbir Singh Batth and Amandeep Nagpal discussed about IORT and usage of robotics in different areas. Authors explained internet of robotics thing in depth and proposed its architecture too. It shows the role of edge and fog computing in IORT" [1].

"Ravi Kishore Kodali and Subbachary Yerroju proposed a model which can detect fire hazards and inform to nearest fire station with location. Authors discussed which circuit and the wok flow of sensors used to develop the model." [2].

"S.R.Vijayalakshmi and S.Muruganand discussed how IOT can be used to monitor fire and safety. In this article, authors describse the wireless and wired safety system with it's prons and cons.

With this they also proposed a framework to develop a fire

monitoring system." [3]. "Noorbasha Johnsaida, Lakkisetty V.Rahul and Tadi Shalini suggested a system which can intelligently guide at the time of fire disaster. Authos explained various tool especially Raspberry pi and sensors in depth which are used to develop a proposed system." [4].
"Abhishek Sharma, Sudha Pal and Vaibhav Jain proposed a model through which communication can take place using GSM during the time of industrial fire calamity" [5].
"Azeta Joseph, Bolu Christian, Abioye A. Abiodun and Festus Oyawal show the possibility of Robots usage in diagonesis and medical surgery. In their artile, they describe th role of Robots in health care profession in near future." [6].
"Linda Daniel and Miltiadis D. Lytras discussed various ways to expand the role of robot in the field of education. An article described the effect of robotics usage in education especially for socioeconomics, cultural diversity, gender and special needs" [7].
"James Lowenberg-DeBoer, Iona Yuelu Huang, Vasileios Grigoriadis and Simon Blackmore shows the benefit of using robotics in the field of agriculture. With this, author also address some challenges which need to be address. Authors provided an opinion on "field crop robots" which provide economic analysis related to the agriculture. This reaseach can guide farmer into their agriculture business." [8].
"Shamshiri1, Cornelia Weltzien, Ibrahim A. Hameed, Ian J. Yule, Tony E. Grift, Siva K. Balasundram,Lenka Pitonakova, Desa Ahmad and Girish Chowdhary discussed the modern farming using robots and drones. An article provides the example of different robots like sweeper, bonirob and many more which can play important role in the field of agriculture" [9].
"Pedersen S., Fountas S and Blackmore S described the way to make the tradition system used for weeding, grass cutting and many other more effective and efficient by merging it with GPS based system although it makes the system little bit costly. Example of MF-scamp robot for scouting, weeding and harvesting is given in a paper. Authors belive that the robotics used in agriculture is expensive and researcher need to find the cheaper alternative option of it."[10].
"Omar Mubin,Catherine J. Stevens,Suleman Shahid,Abdullah Al Mahmud and Jian-Jie Dong discussed the usage of Robots in the field of education to achive the learning objective. An article gives various dimension of robotics in field of eduction with in depth exaplanation." [11].
"Allison M. Okamura,Maja J. Mataric C and Henrik I. Christensen done the literature survey on the usage of robots in the field of healthcare and medical" [12].

VI. APPLICATIONS OF EMBEDDED AND IOT SYSTEM

A. Embedded System in the field of healthcare:

Embedded and IOT systems are plaing vital role in healthcare industries. People are using these devices where availability of doctors is not so often because of remote locations. Recent advancements in robotics in the medical field opend up vertatile applications of robotics. It emerged with new method and specially configured robots which can be used in surgery [13].

B. Embedded System in the field of agriculture:

Innovations in the field of embedded systems yield embedded devices which can be used in the field of agriculture to reduce labor work of farmer.
Famer exploits the devices for weeding, grass cutting, planting and many more [10]. For harvesting of fruits or vegetable. devices must need to detect the object and act according to the intelligence which is provided by human to that device [9].

C. Embedded System in the field of education:

In this modern era embedded system is part of education.Education field can take advantage of such embedded device because they are low in cost, light in weight, compaque in size and low in power consumption. These devices will offer methods to be utilized on various educational platofoms to ehnahce and improve process. [14]. Attendance system, simulator,emulators are example of embedded systems which are currently in trend of education. Pupils start to learn embedded system from the school.

D. Embedded system for national security

Embedded system is essential part of military or defense of any country. Embedded system is as important as weapons of forces. Embedded systems like drone, detect mines, and many more.

E. Embedded system in Industries

Most of industries are using embedded system for production, testing, and for safety management.
Embedded system made task easy for industries. Automate production machine make fast production and packaging.

F. Embedded System in home automation

Home is surrounded by embedded system, which makes homemakers task easy and time saver. The examples of home automation embedded systems are washing machine, microwave, fan, robot to clean the house etc.

VII. PROPOSED SYSTEM

In this era industries moved towards to automated

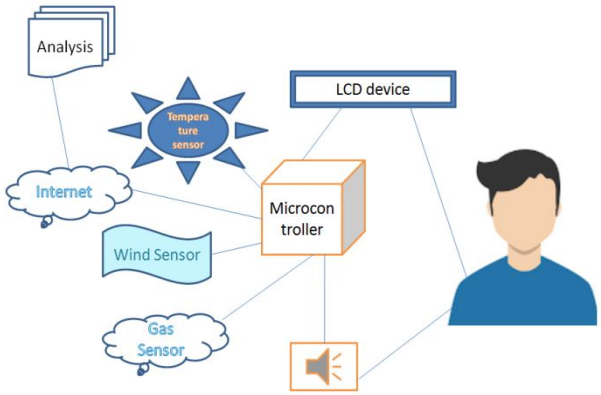

Fig 4

Quality production but the same time there is lacking of safety.
All most all industries are enclosed by embedded system.

In this paper, embedded system is proposed which construct with one microcontroller and the some sensors like gas sensor, flame sensor, temperature sensor and wind sensor.
In the figure 4, explain what proposed system does.
A microcontroller assembles with temperature sensor, wind sensor, gas sensor, buzzer, 16X2 LCD device, and internet storage. Temperature sensor and gas sensor sense the temperature and level of gas in atmosphere. At the time of development user set the predefine limit of temperature and gas level, if sensor sense beyond that level system will alert the people by using buzzer.
Wind sensor given direction to escape and display that direction on LCD. Data of temperature winds and gas sensor will store on cloud on every specific time interval using internet. Cloud storage raw data of sensors help to generate some meaningful data by using data analytics.

VIII. CONCLUSION

As a conlcuion of this paper, the futuristic applications and impact of embedded systems can be visualized. We, as author of this paper want to extend this research of embedded system in manufacturing industries with the extensive use of data analytics. In this paper, we have highlited today and tomorrow of embedded system and second half has also prescribed the basics of data analytics. The data generated through embedded system are expected to be in more pure form as minimal chance of error because data is captured automatically. The speed of data is going to be very high as the data is captured through machine and end less processes are incorporated. These huge amount of data, if caputed by well designed and sophisticated embedded system, can be proved to an essential input for data analytics**.**

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