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ENERGY HARVESTING FOR REMOTE CONDITION MONITORING

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Abstract - *Energy is the basic necessity for economic development of country. It plays vital role in our day to day life. This paper presents energy harvesting techniques which is expedient for use with wireless remote condition monitoring. There are enormous methods of scavenging energy from various sources which is freely available in nature. Energy harvesting techniques applicable for resource monitoring is also presented.*

Key Words: *Energy harvesting, remote condition monitoring, wireless sensor*

1. INTRODUCTION

Energy Harvesting is the process by which energy is derived from external sources such as solar, wind or vibration, kinetic energy also known as ambient energy [1]. It is used for low power application. Generally, power is not directly fed to the load so numbers of power management technologies are used to store electrical power which is used by load. Harvesting of energy is deceiving solution for providing power to equipment which is located at long distances. In rural area and hilly area inadequate amount of power is available. In energy harvesting technique for storage of power battery is used in remote condition monitoring system. So because of battery cost of system is increases [2]. This remote condition monitoring system requires large collectors example, solar panels or wind turbines which is very costly and easily stole by everyone. For reduction of cost of system selection of appropriate component is necessary and moderate power management technique. Energy harvesting devices converts ambient energy into electrical energy have attracted much interest in both the military and commercial sectors. Some system converts motion, such as ocean waves, into electricity which is used by oceanographic monitoring sensors for autonomous operation. It is available for high power output devices in future. The devices which is deployed at remote location to serve as reliable power station for large system. It is also applicable in wearable electronics , and this energy is used for power or recharge the cell phones , mobile computers, radio communication equipment etc. These devices must be sufficiently robust to endure long term exposure to hostile environments and have a broad range of dynamic sensitivity to exploit the entire spectrum of wave motion. Energy can also be harvested to power small autonomous sensors such as those developed using MEMS technology. Scavenging energy from ambient vibration, wind, heat or light could enable smart sensors to be functional indefinitely [2]. Energy harvesting provides many possibilities regarding bringing power options to locations outside the traditional infrastructure and electrical grid. These techniques present the viability of various energy harvesting techniques for wasted thermal, mechanical, light energy on various scales.

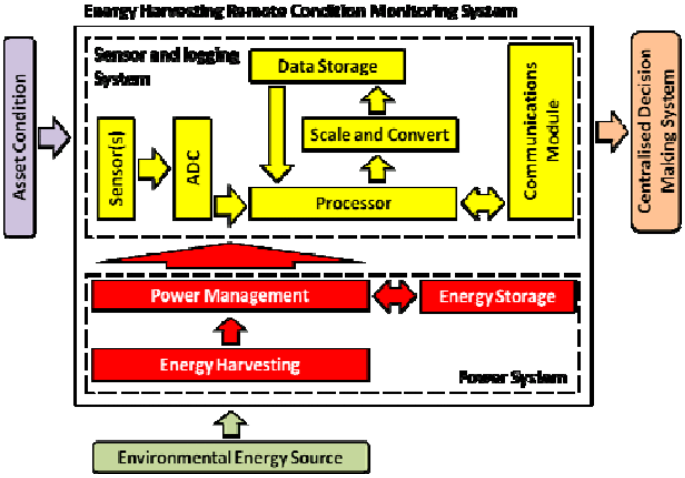

Fig 1: Typical system components for an energy harvesting remote condition monitoring system

The system which is required for remote condition monitoring is explained in fig. 1, these system contains processor which is main component designed to move and process data. Whatever the energy which is derived from external resources such as solar, Wind, vibration, is given to the power management techniques as well as energy harvesting devices. Energy harvesting technologies with power management ICs eliminate the need for batteries. This harvested energy is stored in various devices such as capacitor, super capacitor, rechargeable batteries. Whole RCM system will transfer its data to central decision making system through communication network. The power management system works for conversion of harvested energy in suitable form for storage of energy in storage device [3]. The component scale and convert is used for

conversion of voltage to a level which is suitable for every component in remote condition monitoring system.

2. NEED OF POWER FOR RCM

The power required for the process of remote control monitoring depend upon components their rating as well as in what sense they operated. This figure shows the average current requirement for wireless sensor node under difference condition. The data shown in fig no.2 compares power requirement at difference sample intervals. At every sample point, wireless sensor for 50 ms, then it get samples and powered down. Then processed data is transferred to the wireless sensor network till the next sample point. This wireless sensor node operating with either a 4-20 MA sensor, operate at 600 mw or a 0.33 mw crack measurement sensor. The system power demands are demonstrated by the operating cycle of sensor. even though power requirement for 4-20 mA sensor is greater than crack measurement sensor. When power of wireless sensor node is greater than standby power requirements, as the time of system increases current consumption is decreases. When interval between sample increases power requirements for system demonstrated by sleep current of system. When the ratio of system operation time to sleep time decreases, it becomes crucial to manage standby power system to increase operational life by using various techniques. By decreasing operational power requirement of system not only increases operational life of system but also decreases the size and cost of energy harvesting collector.

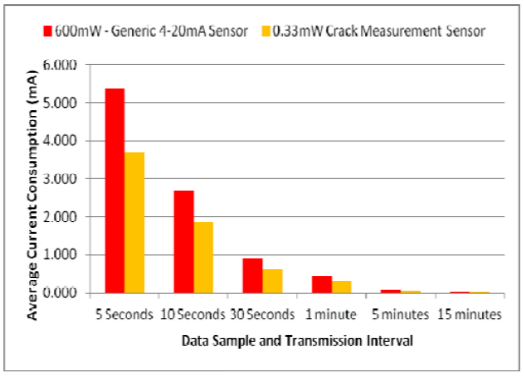

Fig. 2: Average current requirements for a wireless sensor node under different operating condition

3. ENERGY HARVESTING TECHNIQUE

There are various methods of energy scavenging from various environmental sources such as: solar, wind, vibration, and Dynamic compression.

i) Solar

The irradiance level of solar is 1kw/m^2. But this radiance level will not be available for 24 hour period, due to daylight and bad weather condition. This system stores the energy to maintain the system during night period. Battery is also essential for storage to power the end application.

ii) Wind

Wind turbines are very beneficial for remote condition monitoring system. One of the most popular company marlec engineering Co. Ltd. Developed turbines of large diameter such as 50cm. Wind energy provides large amount of power for remote condition monitoring system. When they are mounted at height in open area [4]. Wind turbines need timber for locating the device for better flow of air and located at a great distance away from the ground in order to protect person or any appliances which will be come in contact with blades. But storage of power available from wind turbines is very difficult to anticipate than solar.

iii) Vibration

There are two main types of energy harvesting by vibration such as piezoelectric energy harvesting and electromagnetic vibration energy harvester and output power obtained from this is depend on frequency and amplitude of vibration. For these devices bandwidth increases as the vibration amplitude increases. The vibration generated from passing trains are suitable for harvesting energy but nature of vibration will applied only for a minute, which is too low to effectively power the remote condition monitoring system.

iv) Dynamic Compression

Piezoelectric materials are also developed to produce energy from dynamic forces from road, rail, and also from football. This system is suitable for energy harvesting for remote system or it can be installed over a length of track to provide large amount of power.

4. CONCLUSION

This paper shows overview of energy harvesting with wireless remote condition monitoring system. Energy harvesting from different sources such as, solar, wind, vibration, dynamic compression also discussed. Mainly concluded that the feasibility of particular energy harvesting technology depends on context. And the future of energy harvesting will only grow is also mentioned.

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