CARBON SEQUESTRATION POTENTIAL OF TREE SPECIES OF VPM CAMPUS, THANE

Aishwarya Deshmukh, Nada Noor Shaikh, Neelam Soni and Urmila Kumavat

Department of Botany, VPM's B.N. Bandodkar College of Science, Thane (W) 400601,

Affiliated to University of Mumbai, Maharashtra, India

krishnaurmila@gmail.com

ABSTRACT

Since the industrial revolution, there has been a constant increase in global warming effect due to emission of CO_2. Development of green belts in urban areas can act as an effective sink of CO_2 and can help in managing extra carbon in the atmosphere. Thus green belts of cities are required to assess for carbon sequestration potential. For present work, the green campus of Vidya Prasarak Mandal (VPM) of Thane (Maharashtra, India) has been selected. It is situated along the bank of Thane creek. It covers 13.5 acres in heavily polluted metropolitan city of Thane. It has a thick green cover of 398 trees that can bear considerable capacity to trap CO_2 in the form of biomass. Hence carbon sequestration by trees of VPM campus is evaluated by a non destructive method. The study indicated considerable potential of VPM campuses to mitigate carbon of metropolitan cities.

***Key words*:** VPM campus, Carbon sequestration, Wood density

INTRODUCTION

Global warming is one of the most important environmental issues which need to be attended to on a priority basis. Anthropogenic activities such as burning fossil fuels are one of the chief factors leading to global temperature rise. Increased amount of carbon dioxide is responsible for the increase in sea levels, intensifying wild fires and pollution (Kumar *et al.,* 2012). Since industrialization there has been a constant increase in the amount of atmospheric carbon which is responsible for degrading human health and environmental conditions. Excess of carbon in the environment can be alleviated by carbon sequestration. It is the process of capture and secure storage of carbon in oceans, vegetations, sediments and geological forms that would otherwise be emitted to or remain in the atmosphere (Carbon sequestration, 2020).

Carbon sequestration could be a major tool for reducing carbon emissions from fossil fuels (Jain, 2012). The process of carbon sequestration can be direct or indirect. Further it can be classified as biological, chemical or physical (Conservation in a changing climate, n.d.).

Globally various techniques of carbon sequestration are explored but forests are found to be most efficient in capturing environmental carbon. Terrestrial forests play a major role in capturing carbon in the form of biomass. Forests as well as urban lands and green belts are considered as perfect sites for carbon mitigation. Tree plantation not only helps in combating environmental issues but also enhances the beauty of the city. It also adds to the economic benefits in terms of increasing tourism, creating jobs based in the plant industry (Trees: The Carbon Storage Experts, 2018).

Thane is one such metropolitan city consisting of roughly 18 lakhs of population spread over 147 sq.km (Thane, 2020). Increased number of private vehicles and industrialization is responsible for worsening air conditions in the city. In spite of conducting tree plantation awareness camps and mass tree plantations every year in monsoon, the city is facing alarming rise in air pollution (Fernandes, 2018). To overcome the problem of pollution and global warming efforts are needed on a local level. It is necessary to preserve and conserve green belts and urban forests. Vidya Prasarak Mandal (VPM) of Thane (Maharashtra, India) is one of the prime educational institutes of Thane. It is situated near Thane railway station along the bank of Thane creek. The area witnesses poor quality air due to vehicle pollution. The VPM has a big campus spreading across 13.5 acres with thick green cover of 398 trees which help in reducing carbon dioxide concentration. Hence it felt relevant to evaluate carbon sequestration of VPM campus by tree species.

MATERIALS AND METHODS

The estimation of carbon sequestered by trees can be done by destructive and non destructive methods. In the current study a non destructive method of carbon sequestration is used (Nicolas *et al.*, 2013). The method involves allometric equations which use various parameters, viz., diameter at breast height (dbh), tree height, wood density to calculate the tree biomass. There are two types of allometric biomass equations: volumetric and direct. Volumetric equations calculate the above ground volume of a tree using dbh and tree height for the species. Direct equations yield above ground dry weight of a tree using dbh and tree height.

The study was carried out by a volumetric equation. First diameter at breast height (dbh) was measured then approximate measurement the height of tree was taken. From the girth, the radius of the tree stem was calculated which was further used to calculate the volume of the tree trunk. The volume of the tree trunk was multiplied by the wood density to get the value

of carbon sequestered. The amount of carbon sequestered by individual trees in an area was added to find the total amount of carbon sequestration of VPM campus. The following equations were used.

i) BAH * W, Where, BAH = Biomass above ground * Height, W= Wood density

ii) BAH is calculated as πr^2 * H, Where H = Height of plant

RESULTS

VPM campus consists of 398 trees which showed considerable potential of carbon sequestration. There are more than 100 trees of single plant species, i.e. *Cocus nucifera* (Coconut) which contribute immensely in trapping carbon compared to other plants. After analyses of individual carbon sequestration capacity, top 3 tree species having the high ability to accumulate the carbon and top 3 species of trees having less carbon sequestration potential were recognized. They are given in Table 1 and 2.

Table 1: Tree species with high carbon sequestration ability

Sr No.	Name of the Plant	Total No. of plants	Total Carbon Sequestration value (kg/year)
1.	***Cocos nucifera***	**114**	**115.36**
2.	***Mangifera indica***	**18**	**93.279**
3.	***Peltophoram pterocarpum***	**20**	**31.446**

Table 2: Tree species with low carbon sequestration ability

Sr No.	Name of the Plant	Total No. of plants	Total Carbon Sequestration value (kg/year)
1.	***Azadirachta indica***	**20**	**3.835**
2.	***Moringa oleifera***	**14**	**3.426**
3.	***Pithecellobium dulce***	**4**	**3.115**

CONCLUSION

Thane city is a developing urbanized area which is located in a highly biodiverse part of Western Ghats. It has almost lost major wild plants but has few green belts which help in maintaining air quality. They are also essential for upbringing standard of living in metropolitan city like Thane. In present work, 13.5 acres of green belt of Vidya Prasarak Mandal Campus of Thane had been studied for carbon sequestration potential. Sequestered carbon had been estimated by a non destructive method without cutting the tree. *Cocos*

nucifera, Terminalia catapa and Polyalthia longifolia were found to be the dominant species in VPM campus. *Cocos nucifera* has the maximum carbon sequestration potential. Total carbon sequestered by all trees in VPM campus is 544.87014 kg/year. The data obtained through this study can serve as primary data. It will be useful in future to understand changes in level of atmospheric carbon dioxide due to developmental changes in VPM campus.

ACKNOWLEDGEMENT

The authors are thankful to the management of Vidya Prasarak Mandal, Thane for permitting us to do project work on campus.

REFERENCES

1. Carbon sequestration (2020). Retrieved 23 February 2020 from https://en.m.wikipedia.org/wiki/Carbon_sequestration
2. Conservation in a changing climate: Carbon Sequestration (n.d.). Retrieved 12 February 2020 from https://climatechange.lta.org/carbon-sequestration/
3. Fernandes, F. (2018). In just a week, air pollution levels rise by 36% in Thane. Retrieved 13 February 2020 from http://timesofindia.indiatimes.com
4. Jain, R. (2012). Contemporary Issues in Environmental Assessment. *Handbook of Environmental Engineering Assessment*
5. Kumar, S., Himanshu, S. K. and Gupta, K. K. (2012). Effect of global warming on mankind: A review. *International journal of Environmental Sciences,* 1(4): 56-59.
6. Nicolas., M., Thierry, G., Wadi, B., Valérie, B. M. and Zaoui, El. (2013). A non-destructive method to estimate the aboveground forest biomass in woodlands. *Forest Ecology and Management*. 130: 37-46. 10.1016/S0378-1127(99)00188-7.
7. Thane (2020). Retrieved 13 February 2020 from http://en.wikipedia.org/wiki/thane
8. Trees: The Carbon Storage Experts (2018). Retrieved 10 February from www.dec.ny.gov/lands/47481.html

MICROCONTROLLER BASED HEART RATE MONITORING SYSTEM

Varsha Shinde, Shahina Shekharan and Ashish Koli

Department of Physics, VPM's B. N. Bandodkar College, Thane.

University of Mumbai.

varsha.shinde12@gmail.com

ABSTRACT

Aim of our work is to monitor the human heart rate of the patient. For a patient who is already diagnosed with fatal heart disease, their heart rate condition has to be monitored continuously. This paper proposed an alert system that is able to monitor the heart beat rate condition of patients. The heart beat rate is detected using photoplethysmograph (PPG) technique. This signal is processed using an ATMEL 89S52 microcontroller to determine the heart beat rate per minute. A desired amount of sensor value is set and if it is exceeded preliminary steps should be taken by the indicated LCD monitor. The HEARTBEAT sensor information will be transmitted from the patient unit to the main controller unit with the help of a data communication system which is connected with the microcontrollers in the both units. Thus, doctors can monitor and diagnose the patient's condition continuously and could suggest earlier precaution for the patients themselves. This will also alert the family members to quickly attend the patient. The design method is developed in Embedded C and simulate in KEIL and implemented on Microcontroller ATMEL 89S52.

***Keywords*:** Heart beat sensor, AT89s52 microcontroller, LCD (16*2), LM358, IR sensor (Photo diode & receiver), Crystal (11.0592 MHz)

INTRODUCTION

Health is one of the global challenges for humanity. According to the constitutions of the World Health Organization (WHO) the highest attainable standard of health is a fundamental right for an individual. Healthy individuals also reduce pressure on the already overwhelmed hospitals, clinics, and medical professionals and reduce workload on the public safety networks, charities, and governmental (or non-governmental) organizations. To keep individuals healthy an effective and readily accessible modern healthcare system is a prerequisite. A modernized healthcare system should provide better healthcare services to people at any time and from anywhere in an economic and patient friendly manner.

The heart rate monitor is a personal monitoring device that allows one to measure his or her heart rate in real time or record the heart rate for later study. It's largely used by performers of various types of physical exercise. It's widely used in hospitals for checking the health of

patients. These monitors are very useful in realizing the health conditions of the person according to the age group. The following table shows the average heart rate of the people from different age groups.

AGE	AVERAGE HEART RATE
Newborn	140
7-years	85-90
14-years	80-85
Adult	70-80

There is no doubt about the usefulness of a heart rate monitor. Every time someone visits a doctor, one of the first things the doctor checks is the patient's heart rate or say pulse rate. In medical terms the heart rate of the patient is useful in determining many of his /her medical conditions.

There are many heart rate monitoring systems already present. But our monitoring system has certain advantages over the already present systems. The stethoscope which is the most basic device used by doctors is not very accurate. Another way is to use an electrocardiogram, but it is supposed to be very costly and not user friendly. The heart rate monitor that we have setup does not need any expert advice, since it directly shows the value of heart rate on LCD. Also, it is portable, so can be carried along to places that one travels to. Its cost effectiveness is also an advantage.

WORKING

Photoplethysmography is the process of optically estimating the volumetric measurement of an organ. Pulse oximetry, cardiovascular monitoring, heart rate monitoring etc are few common applications of photoplethysmography. Let us have a look at the application of photoplethysmography in heart rate monitoring from the fingertip. When the heart expands (diastole) the volume of blood inside the fingertip increases and when the heart contracts (systole) the volume of blood inside the fingertip decreases. The resultant pulsing of blood volume inside the fingertip is directly proportional to the heart rate and if you could somehow count the number of pulses in one minute, that's the heart rate in beats per minute (bpm). For this an IR transmitter/receiver pair is placed in close contact with the fingertip. When the heart beats, the volume of blood cells under the sensor increases and this reflects more IR waves to the sensor and when there is no beat the intensity of the reflected beam decreases.

The pulsating reflection is converted to a suitable current or voltage pulse by the sensor. The sensor output is processed by suitable electronic circuits to obtain a visible indication.

The system majorly consists of three components like heart rate sensor circuit, let us see the brief explanation of circuitry (Ch Subudhi and Sivanandam, 2014).

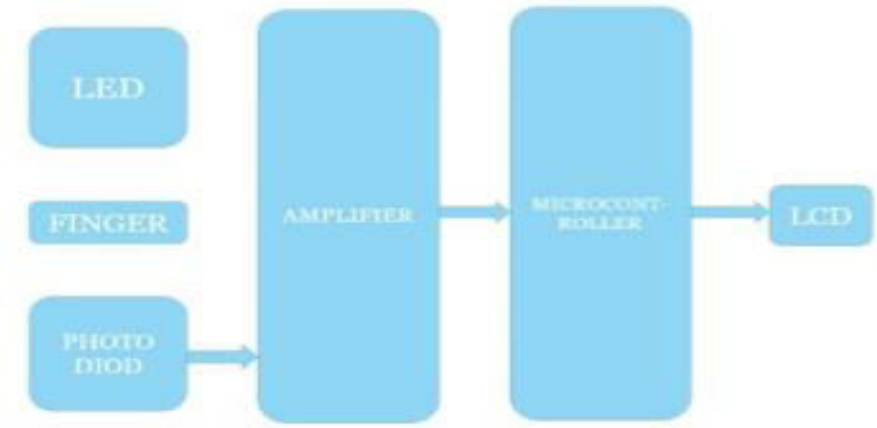

Fig.1 Block diagram

HEART BEAT SENSOR: The Heart Beat signal is obtained by LED & photodiode combination. Pulses form hands interrupt the light reaching the Photodiode and this signal is read by microcontroller, a logical zero is represented by a pulse in the first half of the bit.

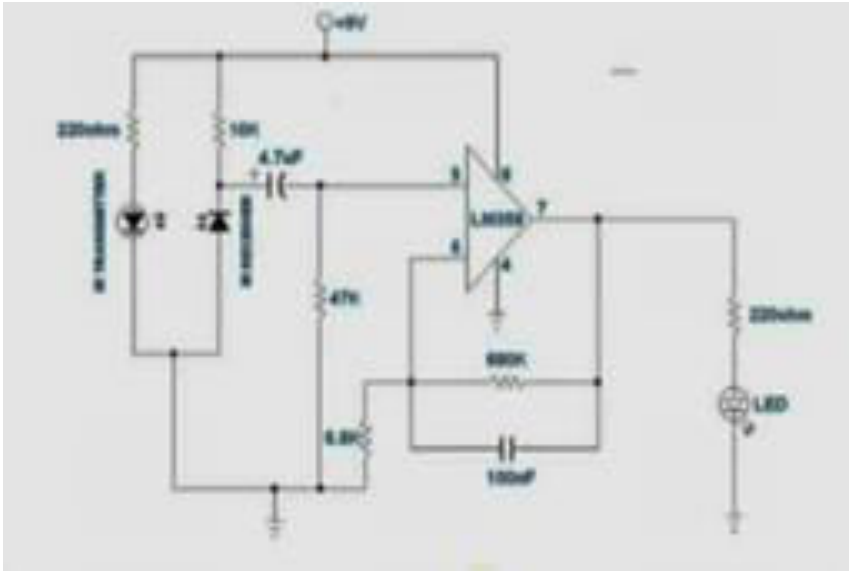

Fig. 2 Heart beat sensor

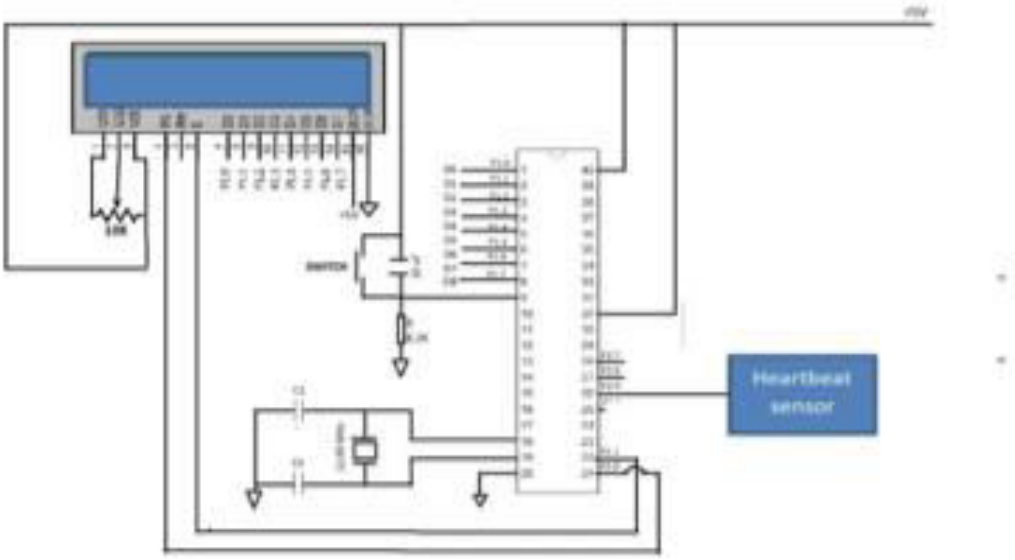

Fig. 3 Circuit diagram

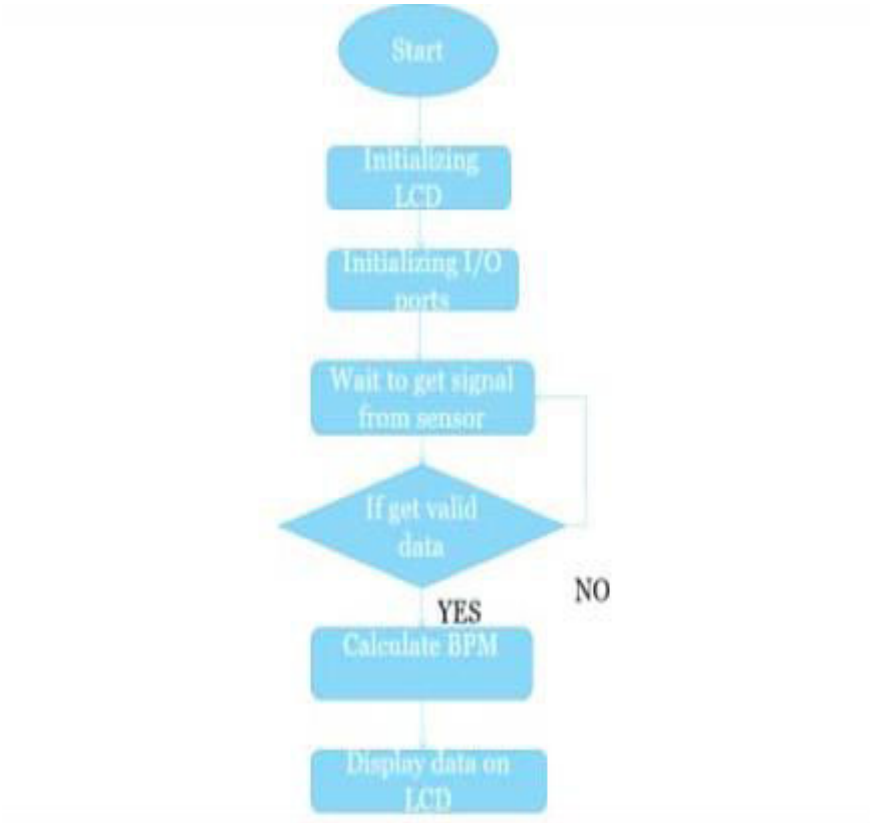

Fig. 4 Flow chart

Heartbeat is measured with the help of fingertip sensor which consists of an infra-red (IR) light emitting diode transmitter and an IR photo detecting receiver. The IR light passes through the tissues and variations in the volume of blood within the finger determine the amount of light that is incident on the IR detector.

The signal produced from photodiodes is very weak and small which is required to be increased in magnitude. This signal is so weak that it cannot be detected by the microcontroller directly. Thus, the signal is amplified using an operational amplifier. The operational amplifier used for this purpose is LM358.

Finally, a red LED is placed at the output of the amplifier stage to show that the device is working for the measurement of heartbeat. The output is connected to a microcontroller that by using the program shows output on LCD (Sali *et al.*, 2016; Parihar, *et al.*, 2017).

CONCLUSION

We introduce the Heartbeat sensor in the embedded C programming to access LM358 & IR sensors. It communicates with ATMEL 89S52. We proposed & experimentally demonstrate the heart rate monitor. The instrument has simple structure, stable and reliable operation, high Accuracy, low power consumption, good portability, full featured function, and extensive application occasion. It can be easily used by patients and keep the patient's moment intact because it is miniature and portable. In future this can be implemented with multiple sensors & communication systems to build it as a wireless health monitoring system.

REFERENCES

1. Ch Subudhi, S. K. and Sivanandam, S.(2014). Intelligent wireless patient Monitoring and Tracking system (Using sensor network and wireless Communication). *International Journal of Interdisciplinary and Multidisciplinary Studies*, 1(3): 97-104.
2. Sali, S., Durge, P., Pokar, M. and Kasge, N. (2016). Microcontroller Based Heart Rate Monitor. *International Journal of Science and research*, 5(5): 1169-1172.
3. Parihar, V. R., Tonge, A. Y. and Ganorkar, P. D. (2017). Heartbeat and Temperature Monitoring System for Remote Patients using Arduino. I*nternational Journal of Advanced Engineering and research and Science*, 4(5): 55-58.