International Journal of Engineering Research-Online
A Peer Reviewed International Journal
Email:editorijoer@gmail.com http://www.ijoer.inISSN: 2321-7758
Vol.5., S1., June 2017
NCETAR - 17
CATEGORY: EEE

A CONVERTER DESIGNE FOR LOW VOLTAGE ENERGY HARVESTING

RAKESH L[1],VIDYASHREE M[2]
[1]Asst Prof, EEE Dept, JIT ,Davanagere, lrakesh24@gmail.com
[2]Asst Prof, Dept of EEE,MSEC, Bangalore,m.vdyashree18@gmail.com

ABSTRACT
Two-stage power converters consisting bridge rectifiers are inadequate and may not be practical for the low-voltage micro generators. This paper presents an adequate ac-to-dc power converter that rmoves the rectification and directly converts the ac input voltage to the required dc output voltage at a maximum efficiency. The proposed converter having a boost converter in parallel with a buck-boost converter, which are operated in the positive half cycle and negative half cycle, respectively. The Closed-loop and open loop simulation is present through MATLAB.
Key Words: AC–DC conversion, boost converter, energy harvesting, low power, low voltage, power converter control.

1. INTRODUCTION

The electronics like laptop, cell phones and the PCs will decipate heat energy as waste. With the thermocouple we can get this energy and we can get the output off around the values in milli-voltage.Same like that we are getting the power from oscillations (vibrations) of the electrical energy. Self-powered devices harvest the ambient energies by microgenerators and can perform their operations without any continuous external power supply. Many types of micro-generators, used in the self-powered devices, are reported in the literature for harvesting different forms of ambient energies. Energy harvesting (also known as power harvesting or energy scavenging) is the process by which energy is derived from external sources (e.g., solar power, thermal energy, wind energy, salinity gradients, and kinetic energy), captured, and stored for small, wireless autonomous devices, like those used in wearable electronics and wireless sensor networks. Energy harvesters provide a very small amount of power for low-energy electronics. While the input fuel to some large-scale generation costs money (oil, coal, etc.), the energy source for energy harvesters is present as ambient background and is free. For example, temperature gradients exist from the operation of a combustion engine and in urban areas, there is a large amount of electromagnetic energy in the environment because of radio and television broadcasting.

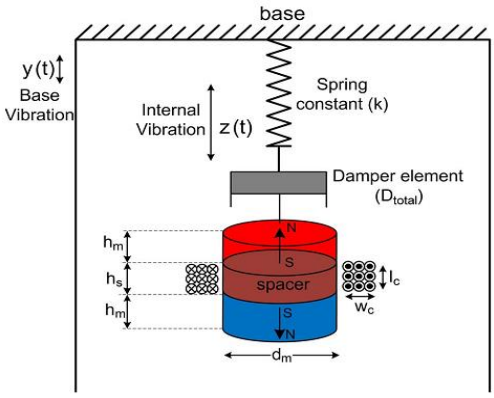


Fig1. Microgenerator structure

The electromagnetic generators are typically spring mass damper based resonance systems in which the small amplitude ambient mechanical vibrations are amplified into larger amplitude translational movements and the mechanical energy of the motion is converted to electrical energy by electromagnetic coupling.The output voltage of an electromagnetic micro generator is ac type,but the electronic loads require dc voltage for their operation.Therefore,the ac voltage of the

electromagnetic micro generator output has to be processed by a suitable power converter to produce the required dc voltage for the load. The electromagnetic microgenerators typically consist of a moving permanent magnet, linking flux with a stationary coil see Fig. 1. The variation of the flux linkage induces ac voltage in the coil. The typical output voltage of an micro generator is sinusoidal. Hence, in this study, the microgenrator is modeled as a sinusoidal ac voltage Furthermore, electromagnetic microgenerators with low output voltages (few hundreds of millivolts) are only considered in this study for energy harvesting.

In these converters, bridge rectification is avoided and the micro-generator power is processed only in a single-stage boost-type power converter [see Fig 2(b)]. A dual-polarity boost converter topology for direct ac-to-dc power converter is report.In this converter, the output dc bus is split into two series-connected capacitors and each of these capacitors is charged only for one half cycle of the microgenerator output voltage. As the time periods of the resonance-based microgenerators' output voltages are normally in the order of milliseconds, very large voltage drops will occur in the capacitors during the half cycles when they are not charged by the converter. Extremely large capacitors will be required to achieve acceptable voltage ripple at the output dc bus. This is not practical due to the size limitations of the microgenerators.

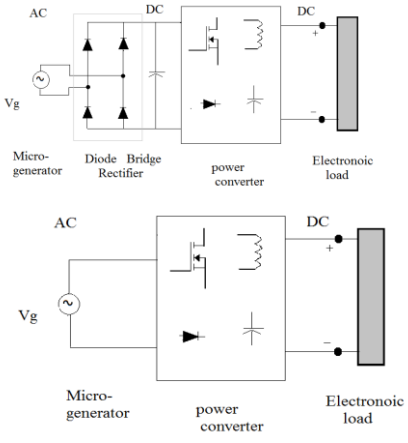


Fig 2.Block diagrams a) Conventional two stage power conversion consisting diode bridge rectifier. b) Direct ac-to-dc converter power conversion

A direct ac-to-dc converter is shown in fig. consists of a boost converter (inductor L1 , switch S1 , and diode, D1) in parallel with a buck– boost converter (inductor L2 , switch S2 , and diode D2). In this converter, the negative output to input voltage gain of a buck– boost converter is utilized to step-up the negative half input voltage of the microgenerator to a positive high-dc output voltage. The output dc bus is realized by using a single capacitor.The output capacitor is charged by the boost converter in the positive half cycle and by the buck–boost converter in the negative half cycle. Therefore, it resolves the problems present in a dual-polarity boost converter.

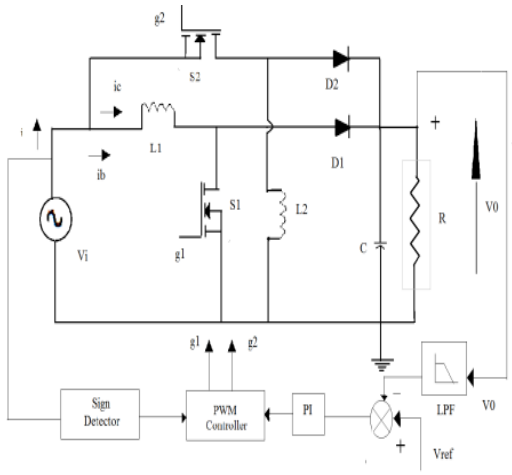


Fig 3. Circuit diagram of direct ac-to-dc converter

2.Direct AC-to-DC Converter

The propose direct ac-to-dc power conditioning circuit, as shown consists of one boost converter in parallel with one buck–boost converter. The output capacitor C of this converter is charged by the boost converter (comprising inductor L1 , switch S1 , and diode, D1) and the buck–boost converter (comprising inductor L2 , switch S2 , and diode D2) during the positive half cycles and the negative half cycles of the sinusoidal ac input voltage (vi), respectively. n-channel MOSFETs are utilized to realize the switches S1 and S2 . It can be noted that the MOSFETs are subjected to reverse voltage by the ac output of the microgenerator. To block the reverse conduction, the forward voltage drop of the body diodes of the MOSFETs is chosen to be higher than the peak of the input ac voltage. Two schottky diodes (D1 and D2) with low forward voltage drop are used in the boost and the buck–boost converter

circuits for low losses in the diodes. It can be mentioned that the diodes can be replaced by MOSFETs to further improve the efficiency of the converter.

The proposed converter is operated under discontinuous mode of operation (DCM). This reduces the switch turn ON and turn OFF losses. The DCM operation also reduces the diode reverse recovery losses of the boost and buck–boost converter diodes. Furthermore, the DCM operation enables easy implementation of the control scheme. It can be noted that under constant duty cycle DCM operation, the input current is proportional to the input voltage at every switching cycle; therefore, the overall input current will be in-phase with microgenerator output voltage. The converter operation can be divided mainly into four modes. Mode-1 and Mode-2 are for the boost converter operation during the positive half cycle of the input voltage. Under Mode-1,the boost switch S1 is ON and the current in the boost inductor builds. During Mode-2, the switch is turned OFF and the output capacitor is charged. The other twomodes:Mode-3 andMode-4 are for the buck–boost converter operation during the negative half cycle of the input voltage. Under Mode-3, the buck–boost switch S2 is ON and current in the buck–boost inductor builds. DuringMode-4, the buck–boost switch S2 is turned OFF and the stored energy of the buck–boost inductor is discharged to the output capacitor,

A. Converter Analysis

Consider the input current waveform of the converter as shown in Fig. 4(a). It can be noted that during the boost converter operation, the input current *i* and the boost inductor current (*iL*1) are equal, but during the buck–boost converter operation, the input current *i* and the current in buck–boost inductor (*iL*2) arenot equal. This is because, in the buck–boost converter the input current becomes zero during the switch turn OFF period (*T*OFF). Therefore, in a switching cycle, the energy transferred to the output by a buck–boost converter is equal to the energy stored in the inductor, whereas, in the boost converter, the energy transferred to the output is more than the energy stored in the inductor.

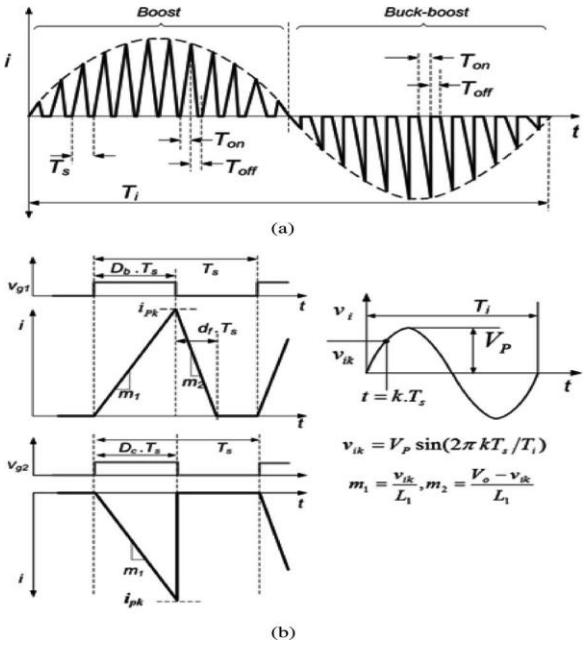


Fig.4. (a) Input current waveform of the converter. (b) Input currents, gate drive signals and input voltage during a switching cycle of boost and buck–boost converter.

Hence, for the equal duty cycles, input voltages and inductor values (*L*1 = *L*2), the total powers delivered by the two converters over an input voltage cycle are not equal. In this section, analyses of the converters are carried out and the relations between the control and circuit parameters of the boost and the buck–boost converters pertaining to the input power and the output power are obtained. Consider any *k*th switching cycle of the boost and the buck– boost converter as shown in Fig. 5(b), where *Ts* is the time period of the switching cycle, *Db* is the duty cycle of the boost converter, *df Ts* is the boost inductor current fall time (or the diode *D*1 conduction time), *Dc* is the duty cycle of the buck–boost converter, *vi* is the input voltage of the generator with amplitude *Vp* , and *Vo* is the converter output voltage. Assuming the switching time period (*Ts*) of the converter is much smaller than the time period of the input ac cycle (*Ti*), the peak value of he inductor current (*i*Pk) in the boost converter can be obtained as in (1)

$$i_{\mathrm{Pk}} = m_1 D_b T_s = \frac{v_{ik} D_b T_s}{L_1}$$

where $v_{ik} = V_p \sin(\frac{2\pi kT_s}{T_i})$. 1

After the boost converter switch is turned OFF, the current in the inductor starts to fall (see Fig. 5). The slope (*m*2) of this current is decided by the voltage across the inductor. In a *k*th switching cycle, the voltage across the inductor during the inductor current fall time is: *Vo − vik* . Therefore, the inductor current fall time can be found as in (2)

$$d_f T_s = \frac{i_{\mathrm{Pk}}}{m_2} = \frac{i_{\mathrm{Pk}} L_1}{V_o - v_{ik}}. \quad 2$$

During this *k*th switching cycle, the total energy (*Ekb*) transferred from the input of the boost converter can be obtained as in (3)

$$E_{kb} = \frac{v_{ik} i_{\mathrm{Pk}} (D_b + d_f) T_s}{2}. \quad 3$$

The average power supplied in the boost switching cycle is

$$P_{kb} = \frac{E_k}{T_s} = \frac{v_{ik} i_{\mathrm{Pk}} (D_b + d_f)}{2}. \quad 4$$

The number of switching cycles during the time period of one input ac cycle is defined as *N* = *Ti/Ts* . In the proposed power electronics converter topology, the boost converter is operated for the half time period of the input ac cycle (*Ti* /2). The average

input power *Pib* of the boost converter over this half cycle time period can be obtained as in (5)

$$P_{ib} = \left(\frac{2}{N}\right) \sum_{k=1}^{N/2} P_{kb} = \left(\frac{2}{N}\right) \sum_{k=1}^{N/2} \frac{v_{ik} i_{\mathrm{Pk}} (D_b + d_f)}{2}. \quad 5$$

For large *N*, the discrete function in (5) can be treated as a continuous function. The average input power of the boost converter *Pib* (5) can be obtained by integrating the term in the summation over the half cycle (*Ti*/2) period of the input ac voltage and then taking its mean value. The average power of the boost converter expressed in the integration form can be obtained as in (6)

$$P_{ib} = \frac{2}{T_i} \int_0^{T_i/2} \frac{D_b^2 T_s}{2L_1} V_p^2 \sin^2\left(\frac{2\pi}{T_i} t\right) \times V_o \left(V_o - V_p \sin\left(\frac{2\pi}{T_i} t\right)\right)^{-1} dt \quad 6$$

where the microgenerator input voltage is defined as: *vi* = *Vp* sin(2π*t*/*T*). Simplifying (6), the average input power for the boost converter *Pib* is found to be as follows:

$$P_{ib} = \frac{V_p^2 D_b^2 T_s}{4L_1} \beta$$

$$\beta = \left(\frac{2}{\pi}\right) \int_0^{\pi} \frac{1}{1 - (V_p/V_0) \sin\theta} d\theta$$

$$\theta = \frac{2\pi t}{T_i}. \quad 7$$

It can be noted that in (7), *β* is constant for fixed values of *Vp* and *Vo* . Also, it is seen that for large switching frequency of the converter, the average power is independent of the microgenerator output voltage frequency.

In steady state, the average input power of the converter is equal to the sum of the average output power and the various converter losses. Hence, by defining the converter efficiency as *η* for a load resistance *R*, the input power and the output power can be balanced as in (8)

$$\frac{V_p^2 D_b^2 T_s}{4L_1} \beta = \frac{V_o^2}{R} \frac{1}{\eta}. \quad 8$$

From (8), the duty cycle of the boost converter (*Db*) can be obtained as

$$D_b = \frac{2V_o}{V_p} \sqrt{\frac{L_1}{RT_s \eta} \frac{1}{\beta}}. \quad 9$$

Further, consider the operation of the buck–boost converter; in this case the input power is supplied only during the ON period of the switch *S*2 (see Fig. 3). During the OFF period of the switch *S*2 , the input current is zero [see Fig. 4(a)]. Hence, for any *k*th switching cycle, the average power supplied by the buck–boost converter *Pkc* can be obtained as

$$P_{kc} = \frac{v_{ik} i_{\mathrm{Pk}} D_c}{2}. \quad 10$$

Applying similar approach, used earlier for the boost converter, the average power can be expressed in the integration form as

$$P_{ic} = \frac{2}{T_i}\int_0^{T_i/2} \frac{D_b^2 T_s}{2L_1} V_p^2 \sin^2\left(\frac{2\pi}{T_i}t\right) dt = \frac{V_p^2 D_b^2 T_s}{4L_1}. \quad 11$$

The duty cycle *Dc* can be obtained as in (12)

$$D_c = \frac{2V_o}{V_p}\sqrt{\frac{L_2}{RT_s\eta}}. \quad 12$$

3 SIMULATION AND RESULTS

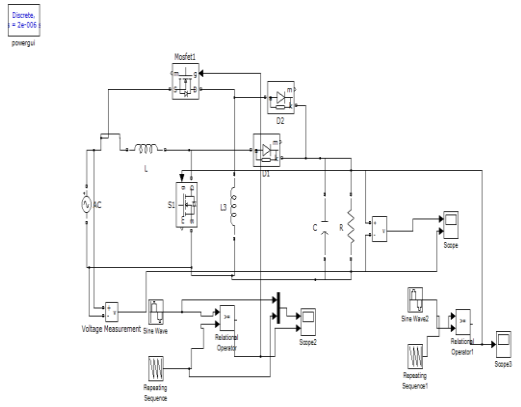
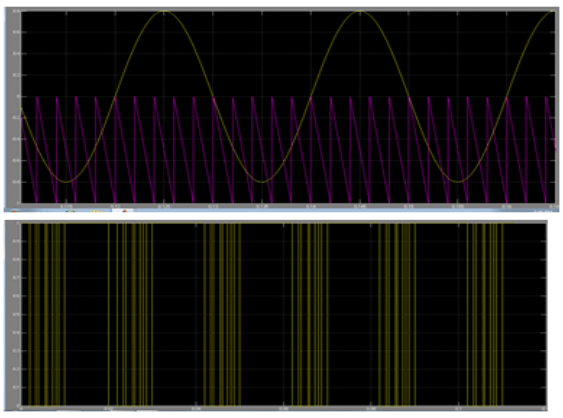


Fig 5. Simulation diagram

A resonance based electromagnetic micro generator, producing 400 mV peak sinusoidal output voltage, with 50-Hz frequency is considered in this study for verification of the propose converter topology (see Fig.3). The closed-loop simula tion of the converter is carried out based on the control schemes presented. The reference output voltage (Vref) is considered to be 3.3V.The energy-harvesting converter is de-signed for supplying power to a 200-Ω load resistance.



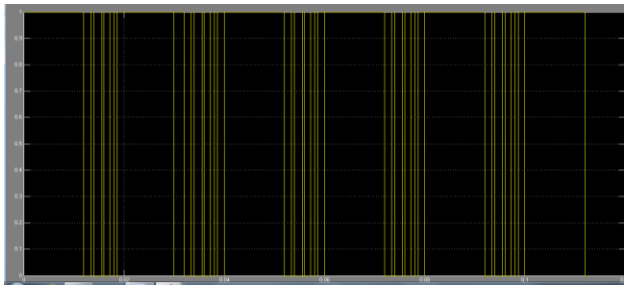


Fig 6.input waveform and switching pulses

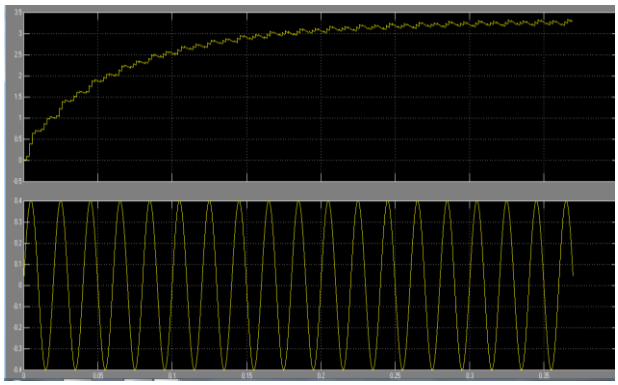


Fig 7.Output Voltage

4 EXPERIMENT RESULTS

The output voltage of the microgenerator is considered as an ac voltage source. The Source amplitude and frequency are set to 400 mv and 100 Hz, Respectively. The reference output voltage (*V*ref) and the ful lload Resistance selected are 3.3 V and 200 Ω, respectively. The measured duty cycle, generated by the PI controller is about 0.75. the low ac input voltage is successfully boosted to a well-regulated higher dc voltage (3.3 V). The duty ratio of the boost and the buck–boost converters are kept to be the same.

5 CONCLUSION

The present direct ac-to-dc minimum voltage energy-harvesting converter avoids the existing bridge rectification and achieves mximum efficiency. The propose converter consists of a boost converter in parallel with a buck–boost converter. The negative gain of the buck–boost converter is utilized to boost the voltage of the negative half cycle of the microgenerator to positive dc voltage. Detailed analysis of the converter for direct ac- to-dc power conversion is carried out and the relations between various converter circuit parameters and control parameters are obtained. Based on the

analysis, a simplified control scheme is proposed for high-voltage step-up application.

References

[1]. J.A. Paradiso and T. Starner, "Energy scavenging for mobile and wireless electronics, "IEEE Pervasive Comput.,vol. 4, no. 1, pp. 18–27, Jan./Mar.2005.

[2]. J.R.Amirtharajah "Self-powered signal processing using vibration-based power generation," IEEE J. Solid-State Circuits, vol. 33, no. 5, pp. 687–695, May 1998.

[3]. S. Meninger, J. O. Mur-Miranda, R. Amirtharajah,A.P. Chandrakasan,and J. H. Lang, "Vibration-to-electric energy conversion," IEEE Trans. Very Large Scale Integr. Syst., vol. 9,no. 1, pp. 64–76, Feb. 2001.

[4]. M. El-Hami, P. Glynne-Jones, N. M. White, M. Hill, S. Beeby, E. James, A.D. Brown, and J. N. Ross, "Design and fabrication of a new vibration- based electromechanical power generator," Sens. Actuators A: Phys., vol. 92, pp. 335–342, 2001.

[5]. T. M. Thul, S. Dwari, R. D. Lorenz, and L. Parsa, "Energy harvesting and efficient power generation from human activities," in Proc. Center Power Electron. Syst. (CPES) Semin., Apr. 2007, pp. 452–456.

[6]. N.G. Stephen, "On energy harvesting from ambient vibration," J. Sound Vibrations, vol. 293, pp. 409–425, 2006.

International Journal of Engineering Research-Online
A Peer Reviewed International Journal
Email:editorijoer@gmail.com http://www.ijoer.inISSN: 2321-7758
Vol.5., S1., June 2017
NCETAR - 17
CATEGORY: EEE

VEHICULAR OVERLOAD DETECTION AND PROTECTION

H.D.KATTIMANI[*1] ,MEGHANA N R[#2], NAGASHREE B[#3], SAHANA MUNEGOWDA[#4], VIJAYALAKSHMI S[#5]

[*]Faculty,Dept.of EEE, BMSIT&M,India
[#S]tudent,Dept.of EEE, BMSIT&M,India
[1]hdk.bms@gmail.com;[2]meghananrgowda95@gmail.com;[3]nagashree2195@gmail.com
[4]sahanam64@gmail.com;[5]vijayalakshmis159@gmail.com

ABSTRACT

The growth of every country's economy is measured by the growth of its transport infrastructure.With the gradual development of economy, the scale of transportation industry continues to expand. The problem of overload in the vehicle transport has emerged. Therefore, how simple and conveniently to know the vehicle load and how to effectively limit overload has become a key issue. Vehicle load control system integration device can detect conveniently vehicle load to prevent overloading of vehicle and improve vehicle safety and it can effectively reduce heavy work of the vehicle load testing station and improve work efficiency in transport sector.

I. INTRODUCTION

The present work focus on prevention of damage of roads and prevent vehicle damage. Roads now-a-days play a very important rolein every part of world.

The value lies in providing safe and convenient travel for the users. As the device is working in the loading process, it can ensure to prevent vehicle overloading; in the process of driving, the drivers don't have to worry about being fined due to overload syndrome; ensure the personal safety of driving. At the same time the system is designed to save the national highway maintenance fees and to ensure the safety of people's lives and property; it can solve the problem of the damage of highway bridges, can also travel to provide a more humanized service life for the people and for the country's economic construction contribute a strength.

To sense the overloading effect well in advance there has to be a technology which focus on the calculation of the pay load and compares with the legal limits.

*A. Overload and Road Safety:*The safety issues and the cost issues are to be identified based on overloading and hence the National department of transport has incorporated a campaign against overloading in its Road Safety strategy.

Overloading of commercial vehicles has a major impact on the life expectancy of road networks. The cost of premature road failure and repairs is a major burden on many governments particularly in developing countries where this problem diverts vital funding that could otherwise be spent on health and education. The overloading problems should be controlled or else the extra expenses will be beared by the people which will result in extra wages to be paid in terms of overloading penalty, extra fuel consumption charges and also the trucks carrying goods beyond the permitted load will end up paying 10 times higher the toll charges. This imposes a serious problem on both economical aspects and also upon maintenance of roads. Overloading is a safety hazard that leads to unnecessary loss of life and also the rapid deterioration of our roads, resulting in increased maintenance and transportation costs. In India the midst of building national highways under

the NHDP(NATIONAL HIGHWAY DEVELOPMENT PROGRAMME) entails huge investment ,which will last for at least 10-12 years. However even a 10% overloading of goods carriage in excess of prescribe weight can reduce the life of roads and highways by 35%.

B. *Overloading a Vehicle will pose the following risks:* Different vehicles have different maximum weights for which they are designed .Hence if this maximum weight exceeds than it is difficult to stop the vehicle and thus the vehicle becomes less stable .Effectiveness to stop the vehicle decreases due to overheating of breaks which will result in harder breaking mechanism as the vehicle is heavier. The parts of the vehicle are of great concern and overloading will incur major loss or reduction in their effective usage and will decrease the efficiency of the vehicles. As the overloading is illegal the insurance covered by it becomes invalid. Overloaded vehicles produce higher kinetic energy, resulting in greater impact forces and damages to other vehicles or to the infrastructure. The other common problems on National highways is overloading of trucks beyond the specified height and length limits. In 2014 these two causes have resulted in 36,543 deaths.

In a significant judgment on November 9, 2005,the supreme court said the issuance of gold cards/tokens under notifications issued by 9 state government ,allowing overloading of trucks in excess of prescribed weight limits, after payment of fixed charges ,was a violation of motor vehicle act 1988,and central motor vehicle rule 1989 and should not only be stopped immediately but also the over loaded cargo should be offloaded at the point of penalty the cost of which has to be borne by the transporter. This all causes a major uncertainty, does need a solution to prevent the risks.

C. Objective of the Project: The aim of this project is to identify the effectiveness of using overload system in enhancing the operations in enforcing vehicle weight limit regulations. Specifically, this project attempts to quantify the effect of overloaded vehicle and protect the system and infrastructure of the roads.

II. PROCEDURE

In this project, the feasibility of vehicle load control system through the strain gauge load cell installed in the vehicle, the single-chip microcontroller receives the information transmitted by the weight sensors and calculates the total weight of the vehicle load; if overweight, the single-chip microcontroller will send commands to the vehicle system to prevent the start of the system.

A. *Working* : The load sensor that is placed on the chassis collects,the vehicle load information accurately and reliably and transit the real-time information to the computer processor efficiently and safely using the single-chip microcontroller the information can be received in the form of variety of amplified signals by load sensors in harsh environment, calculates the total load and then transmit the data to the LED. According to different vehicle load, the single-chip microcontroller will choose whether to send instruction to the ignition system.

The design of the vehicle consists of Gross Vehicle Weight(GVW) and Kerb Weight specifications which is given to the load system. It calculates the pay load capacity which is given by

PL = GVW – KW

Then, compares the applied load with the calculated pay load.

CASE 1:If the applied load is up to 95%of pay load then it can be considered as SAFE LOAD.

CASE 2:If the applied load is between 95% to 105% it is taken as THRESHOLD and the signal is sent to LED, the LED glows indicating the safe limit ended and is also displayed on the LCD.

CASE 3: If the applied load exceed the threshold then the signal is passed to the LED , LCD and Relay. The relay gets operated and supply is disconnected to the ignition system.

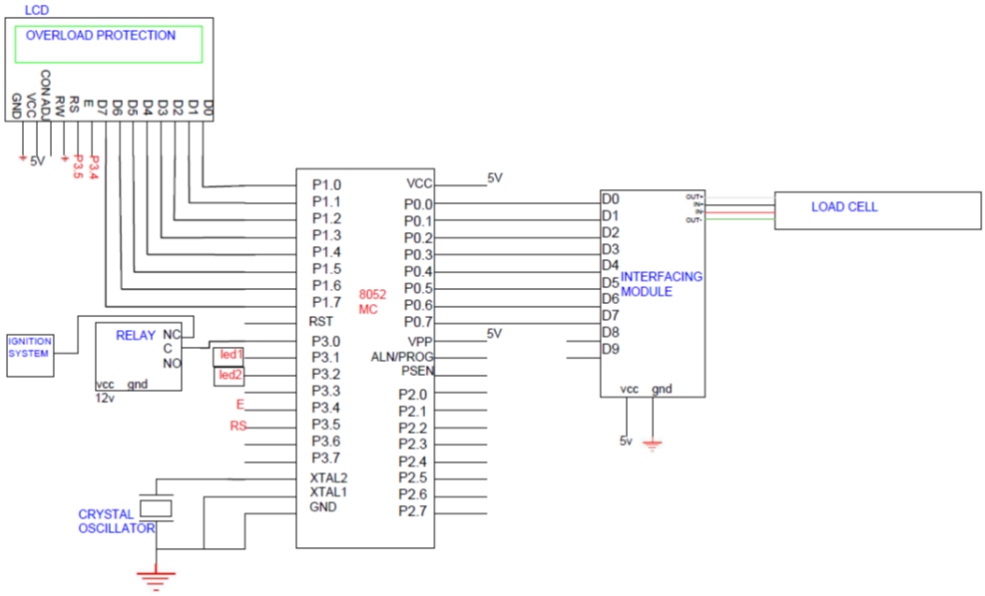


Fig. 1 Circuit diagram for overload protection system

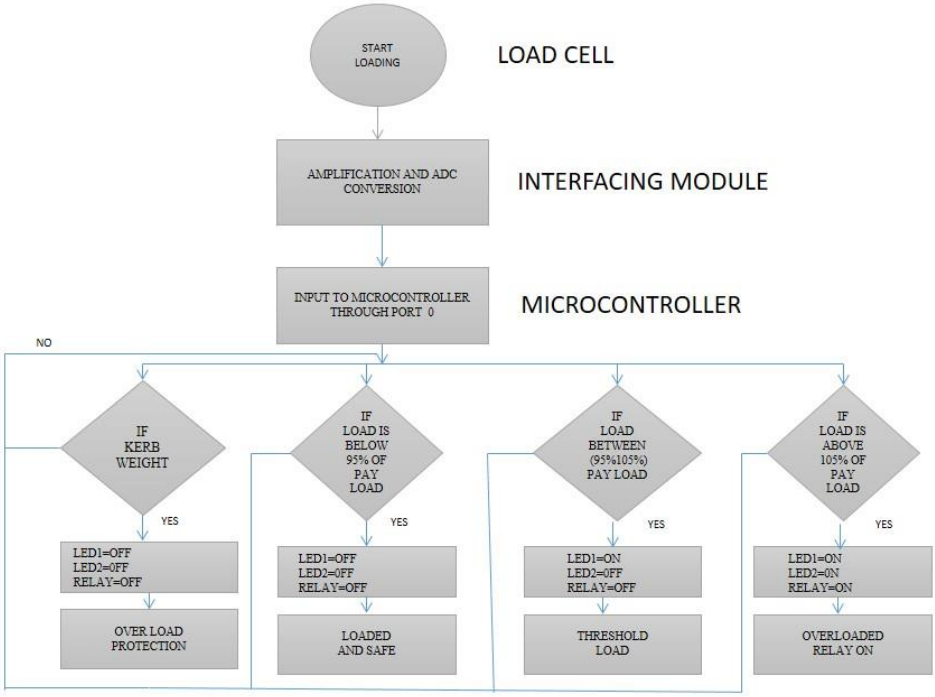


Fig. 2 Flowchart for the system

II. CONCLUSION

Overloading prevention system is a useful tool to contribute towards more compliance with mass regulation. It could help to reduce the number of overload trucks and contribute to the more efficient and effective use of roadways. A reduction in overload trucks is also conducive to a reduction in crashes and serious damage to people's lives and property. New applications of these systems are expected both for traffic and heavy vehicle regulation enforcement. Therefore this system is simple and convenient to know the vehicle load and solve the problem of vehicle overloading effectively.

REFERENCES

[1]. A.A. Mulla, Z. A. Mulla, *Microcontroller based weighing machine,*

[2]. Jun Li, Yanzhao Su, Jinli Xie,Yangjiao Xu& Lei Ji,*Research of the Vehicle Load Control System Integration Device* .Studies in Engineering and Technology Vol. 1, No. 2; August 2014.

[3]. Mohamed Rehan Karim, Ahmad Saifizul Abdullah, Hideo Yamanaka, Airul Sharizli Abdullah, RahizarRamli ,*Degree of Vehicle Overloading and its Implication onRoad Safetyin Developing CountriesImpact analysis:Supreme Court's order on overload,*february 2006

[4]. Raj Reddy,*Analysis of Overloading Prevention System in Trucks*, (Special Issue on NCRIET-2015).amalgated instrument co pty ltd.*Load cell system fault finding guide*,

[5]. Sadaqat Ullah Khana , Tehmina Ayubb,*, Adnan Qadira,Effect of overloaded vehicles on the performance of highway bridge girder: A case study *How Payload works*bY john fulleR auto | vehicle towing capacity

[6]. Rupal Shah1, Yogesh Sharma, Binil Mathew3, Vijay Kateshiya and Jatin Parmar51*Review Paper on Overloading Effect.*

AUTHOR PHOTOS AND BIOGRAPHY

1.**H.D.Kattimani** received BE from Gulbarga University and MS(Electronics and controls) from Birla Institute of technology , Pilani, Rajasthan. He is working as Associate professor in the Department of Electrical and Electronics Engineering in BMS Institute of Technology & Management, India. He has an experience of 26 years in teaching profession. His area of interest is power electronics ,drives and controls.

2.**Meghana N R** was born on 1-07-1995 at Bangalore, Karnataka, India.She is presently pursuing her 4th year Bachelors of Engineering in Electrical and Electronics in BMS Institute of Technology & Management, Bangalore, Karnataka, India. Her area of interests are Microcontroller, Embedded system, Transmission and Distribution and Electrical Machine Design.

3.**Nagashree B** was born on 21-11-1995 at Bangalore, Karnataka, India. She is presently pursuing her 4th year Bachelors of Engineering in Electrical and Electronics in BMS Institute of Technology & Management, Bangalore, Karnataka, India. Her area of interests are Microcontroller, Embedded system, Control System and Electrical Machine Design.

4.Sahana Munegowda was born on 2-11-1995 at Bangalore, Karnataka, India. She is presently pursuing her 4th year Bachelors of Engineering in Electrical and Electronics in BMS Institute of Technology & Management, Bangalore, Karnataka, India. Her area of interests are Microcontroller, Embedded system, Computer Aided Electrical Drawing and Electrical Machine Design.

5.**Vijayalakshmi S** was born on 15-09-1995 at Bangalore, Karnataka, India. She is presently pursuing her 4th year Bachelors of Engineering in Electrical and Electronics in BMS Institute of Technology & Management, Bangalore, Karnataka, India. Her area of interests are Microcontroller, Power Electronics, Transformer and Induction Motor and Electrical Machine Design.

International Journal of Engineering Research-Online
A Peer Reviewed International Journal
Email:editorijoer@gmail.com http://www.ijoer.inISSN: 2321-7758
Vol.5., S1., June 2017
NCETAR - 17
CATEGORY: EEE

ANIMATRONIC ARM

KATTIMANI H D[1], UPDESH SHARMA[2], R G NAVEEN[3], SHASHANK CHAUHAN[4], ROY VARGHESE P[5]

[1] HoD, Dept. of EEE Engineering BMSIT
[2,3,4,5]Students, Dept. of EEE Engineering BMSIT
Doddaballapur Main Road, Avalahalli, Yelahanka, Bengaluru, Karnataka 560064, India
hdk.bms@gmail.com;Updeshsharma53@gmail.com;navsonix@gmail.com;shankchauhan47@gmail.com
exroynator@gmail.com

ABSTRACT

This project discusses the design and implementation of a wireless animatronic hand using XBee-S2, Arduino-MEGA boards and MPU6050 Gyroscope. The main aim of this paper is to highlight mainly the use of wireless communication and it's applications by using wireless animatronic hand. The project was implemented using control glove micro servo motors, XBee-S2 and Arduino-MEGA boards having on-board Atmega-328 and MPU6050 Gyroscope.

I. INTRODUCTION

Wireless animatronic hand is basically a robotic hand which is implemented by using a latest wireless technology. Intension of this project is to get involved in many of the industries where human hand is must to complete the required task; but it may harm human skin or bones. Here, instead of using actual human hand, we can replace it by this wireless robotic hand. We may allow this robotic hand to complete the same task so that the risk will be avoided and obviously, required task can be achieved. For example, consider a Nuclear power plant where highly hazardous fuel is to be handled every day. In this case, to handle extremely hazardous substances like Uranium, thorium etc. If we will allow this wireless animatronic hand, it will be safer for everyone. This project intends to implement an affordable wireless robotic hand. Basically there are two main parts of this project i.e. transmitter (Control glove) and receiver (mechanical-electronic robotic hand). Control glove mainly consists of flex sensors. There are total five flex sensors placed separately on each finger on the glove. Human hand will control another robotic hand; so that it is called as a control glove. Future efforts would be to make this hand to fly as well as to move from one place to another.

The animatronic arms which exist now include only the hand and not the entire arm, also since most of them are autonomous the intervention of human calibration is tedious and the delicate and careful feedback system provided by a human being is not available. We do this by the use of MPU60-50, which will indicate the movement of the arm and we incorporate this into the robotic arm.

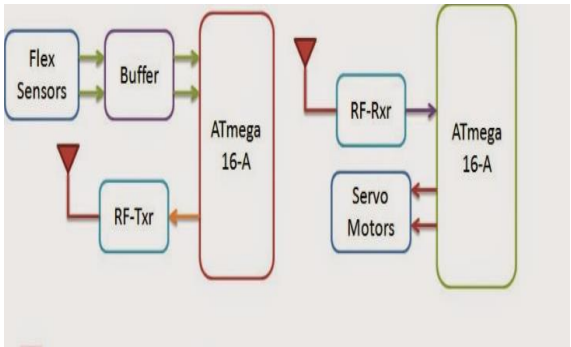


Fig. 1 Block diagram of the animatronic arm

II. PROCEDURE

A. *Xctu software and xbee:* The xbee wireless module was used because of it speed at which the data could be sent i.e. max of 115200 baud rate and its range of 200 meters. The xctu software was used

to initialize the xbee modules. The xbee's are considered to be a form of a network in which there are coordinator, router and end devices which can work in API mode (duplex) and AT mode (simplex). Also there needs to be a coordinator in each network. For our project we decided that we needed a coordinator and router both working in AT mode. For the linking of the router and the coordinator they had to have the same Pan ID and also the same operating ID, the operating ID will be automatically given to the devices once the Pan ID's are given and both of them are powered at same duration of time. We used an xbee shield to initialize the xbee's by bypassing the ardiuno chip by connecting the reset pin to ground .To differentiate between the coordinator and the router we could see that the coordinator shield was blinking once per second and the router shield was blinking twice per second. To make sure we were operating at 115200 baud rate we change in the baud rate in the code, the device manager, in the xctu software and in the serial port so as to see the data which is been sent and received. We observed that the communication from coordinator to router was slower as compared to router to coordinator .So we made the router where the data from the flex senor is taken and the coordinator as the device to the data is sent and the motors are given their appropriate signal to rotate to the required degree .We also observed that by increasing the baud rate the distance of wireless transmission reduces. Also one thing we observed is that when you are resetting the xbee module once you reset it you must write it to write the default values on to the xbee or else it won't reset.

B. *Servo motor:* Unlike dc motors, with servo motors you can position the motor shaft at a specific position (angle) using control signal. The motor shaft will hold at this position as long as the control signal not changed. This is very useful for controlling robot arms, unmanned airplanes control surface or any object that you want it to move at certain angle and stay at its new position. Servo motors may be classified according to size or torque that it can withstand into mini, standard and giant servos. Usually mini and standard size servo motors can be Powered by Arduino directly with no need to external power supply or driver. The servo have 3 wires: Black wire: GND (ground), RED wire: +5v, Coloured wire: control signal.

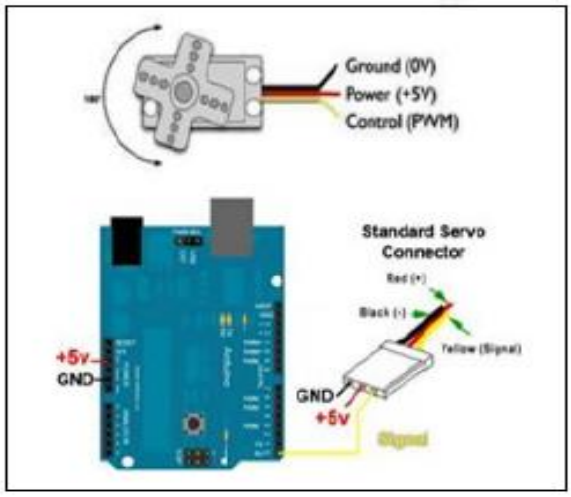


Fig. 3 Servo motor connection

The third pin accept the control signal which is a pulse-width modulation (PWM) signal. It can be easily produced by all micro- controllers and Arduino board. This accepts the signal from your controller that tells it what angle to turn to. The control signal is fairly simple compared to that of a stepper motor. It is just a pulse of varying lengths. The length of the pulse corresponds to the angle the motor turns to. The pulse width sent to servo ranges as follows: Minimum: 1 millisecond ---> Corresponds to 0 rotation angle.

Maximum: 2 millisecond ---> Corresponds to 180 rotation angle. Any length of pulse in between will rotate the servo shaft to its corresponding angle. For example: 1.5 Ms pulse corresponds to rotation angle of 90 degree. This is will explained in figure below:

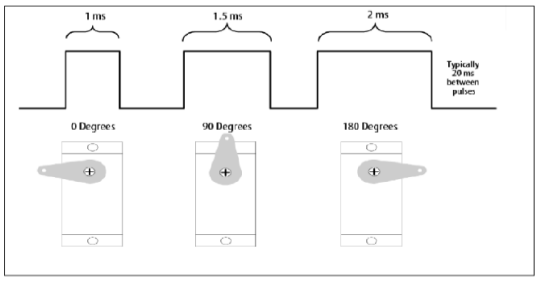


Fig. 2 Rotating configuration of servo motor

C. *Flex sensor:* Flex sensors are sensors that change in resistance depending how much the

sensor is bend. Sensors convert the change in bend to electrical resistance - the more the sensor bend, the higher the resistance value. Using the Flex Sensor is very easy. There are couple of different manufacturers in the market. Datasheet instructs you to use operational amplifier (op amps). That may be useful if you plan to use flex sensor as stand-alone device (without any microcontroller).Because we are using arduino, we skipped all Op Amps and made a very simple circuit with only one additional resistor.

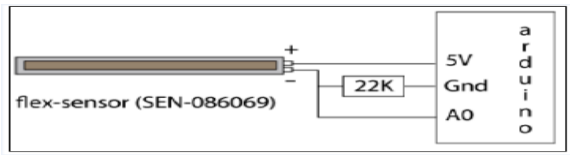


Fig. 4 Simple flex sensor circuit

Varying the value of the resistor will results different readings. With 22k Ohm resistor I will get values between 300-700. This works fine for us. In our code we assumed that all values under 400 mean that the sensor is bend. All values above 600 mean that sensor is nor bend. Note that Flex sensor give reliable readings ONLY if you bend it on the specific direction (usually towards on the text side of the sensor).

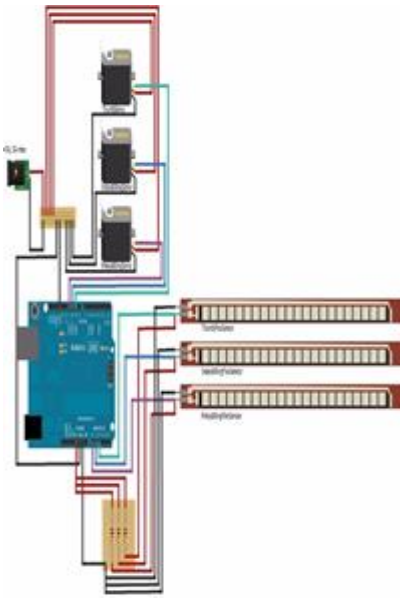


Fig. 5 Circuit diagram of flex sensor, servo motor and the ardiuno

D. *Ardiuno Code :*The Arduino runs a simplified version of the C programming language, with some extensions for accessing the hardware. All Arduino instructions are one line. The board can hold a program hundreds of lines long and has space for about 1,000 two-byte variables. The Arduino executes programs at about 300,000 source code lines per sec. Programs are created in the Arduino development environment and then downloaded to the Arduino board. Code must be entered in the proper syntax which means using valid command names and a valid grammar for each code line. The compiler will catch and flag syntax errors. Before download. Sometimes the error message can be cryptic and you have to do a bit of hunting because the actual error occurred before what was flagged.

```
#include <Servo.h>

int motor[7] = {0, 0, 0, 0, 0, 0, 0};

int pos = 5;

int j = 0;

char ch;

int servoPin2 = 2;

int servoPin3 = 3;

int servoPin4 = 4;

int servoPin5 = 5;

Servo armServo1;

Servo armServo2;

Servo armServo3;

Servo armServo4;

void setup() {

 // put your setup code here, to run once:

 Serial.begin(115200);

 armServo1.attach(servoPin2);

 armServo2.attach(servoPin3);

 armServo3.attach(servoPin4);

 armServo4.attach(servoPin5);

}

void loop() {

 // put your main code here, to run repeatedly:

 j = 0;
```

```
if (Serial.available() > 0) {
 if ((ch = Serial.read()) == 'A')
  motor[0] = Serial.parseInt();
 //   Serial.print(motor[0]);
 if ((ch = Serial.read()) == 'B')
  motor[1] = Serial.parseInt();
 //  Serial.print(motor[1]);
 if ((ch = Serial.read()) == 'C')
  motor[2] = Serial.parseInt();
 //   Serial.print(motor[2]);
 if ((ch = Serial.read()) == 'D')
  motor[3] = Serial.parseInt();
 if ((ch = Serial.read()) == 'Y')
  motor[4] = Serial.parseInt();
 if ((ch = Serial.read()) == 'P')
  motor[5] = Serial.parseInt();
 if ((ch = Serial.read()) == 'R')
  motor[6] = Serial.parseInt();
 //  Serial.println(motor[3]);
 for (j = 0 ; j <= 3 ; j++)
 {
  Serial.print(motor[j]);
  Serial.print("-");
  pos = map(motor[j], 0, 500, 0, 180);
  pos = constrain(pos, 0, 180);
  Serial.print(pos);
  switch (j) {
   case 0:
    armServo1.write(pos);
    delay(50);
    break;
   case 1:
    armServo2.write(pos);
    delay(50);
    break;
   case 2:
    armServo3.write(pos);
    delay(50);
    break;
   case 3:
    armServo4.write(pos);
    delay(50);
    break;
  }
 }
 Serial.println();
}
}
```

E. MPU-6050 Six-Axis (Gyro + Accelerometer) MEMS Motion Tracking Devices

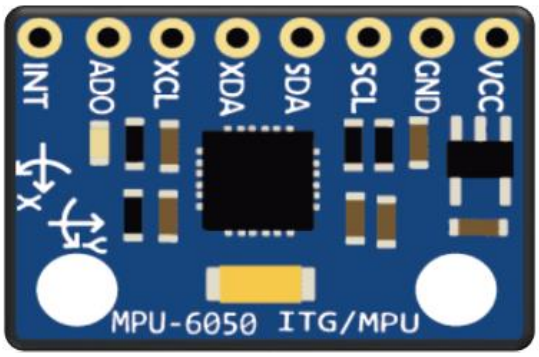


Fig. 6 MPU 6050 board

- The MPU-6050™ parts are the world's first Motion Tracking devices designed for the low power, low cost, and high-performance requirements of smartphones, tablets and wearable sensors.
- The MPU-6050 devices combine a 3-axis gyroscope and a 3-axis accelerometer on the same silicon die, together with an on-board Digital Motion Processor™ (DMP™), which processes complex 6-axis Motion Fusion algorithms.

- The device can access external magnetometers or other sensors through an auxiliary master I²C bus, allowing the devices to gather a full set of sensor data without intervention from the system processor. The devices are offered in a 4 mm x 4 mm x 0.9 mm QFN package
- The MPU-6050 had a problem of reading wrong data due to external disturbances so in the program we hand an internal filter to remove the unwanted sinusoids.

F. Stepper motor

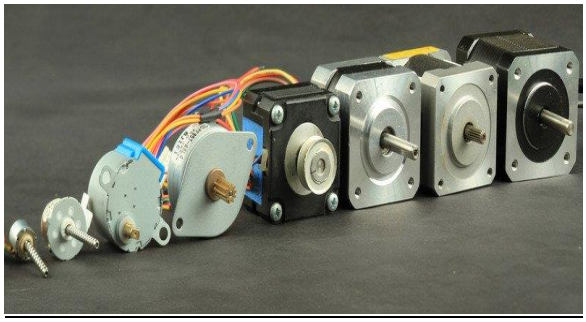


Fig. 7 various stepper motors available

We decided to use the NEMA 17 and NEMA 23 stepper motors to move the base of the hand and we have used a supply of 12 volts 10 amperes capacity.

III. CONCLUSION

We chose to complete this project on an Arduino platform because of its versatility of classes. We can say that compared to writing C++, by the use of libraries like "servo.h ","I2Cdev.h", "MPU6050_6Axis_MotionApps20.h" and "Wire.h" in Arduino it gives a much easier way of programing . But we also explored the libraries which taught us a lot about what is happening behind the scenes. One of the few things we learned from this project is that servos and flex sensors in positioning, timing and environmental texture can lead to all sorts of undesirable readings. We were a bit disappointed with the performance of the SG90 servos in this particular use case as it required a lot of the fine-tuning to get readings accurate as the servo rotated and also it could not produce the necessary torque required. Hence we upgraded to servo motor and also we provided it with a smps of 5 volts 10 amperes. Also the MPU6050 IMU sensor did not have an external filter so filter in the code was provided to filter out other components which was causing it to produce wrong values.

Although the Animatronic hand did not operate with no errors, it is a great success overall. The Animatronic hand met all safety restrictions, easy to operate and energy efficient. This types of animatronic hand can be used for various purposes. The Animatronic Hand can be implemented in all the sectors where human interaction is needed, like- Handling of the explosive objects, performing various sophisticated operational jobs in the medical sectors, Industrial manufacturing etc.

REFERENCES

[1] The Absolute Beginner's Guide to Arduino http://forefront.io/a/beginners-guide-to-arduino

[2] Principles of Robotics http://www.g9toengineering.com/resources/robotics.htm

[3] Servo Motor | Servo Mechanism | Theory and Working Principle http://www.electrical4u.com/servo-motor-servo-mechanism-theory-and-working-principle/

[4] DC Servo Motors | Theory of DC Servo Motor http://www.electrical4u.com/dc-servo-motors-theory-and-working-principle/

[5] Introduction to Servo Motors http://mechatronics.mech.northwestern.edu/design_ref/actuators/servo_motor_intro.html

[6] DIY Robotic Hand Controlled by a Glove and Arduino by dschurman http://www.instructables.com/id/DIY-Robotic-Hand-Controlled-by-a-Glove-and-Arduino/

[7] Animatronics http://en.wikipedia.org/wiki/Animatronics

[8] Simple Servo Bed for InMoov http://www.thingiverse.com/thing:65274

[9] AniHand - Animatronic Hand http://letsmakerobots.com/node/34639

[10] Calibrator: An Arduino library to calibrate sensors hooked to analog inputs http://julianvidal.com/blog/calibrator-an-arduino-library-to-calibrate-sensors-hooked-to-analog-inputs/

[11] Arduino - Begin. http://arduino.cc/en/Serial/begin
[12] Arduino learning pdf http://www.ele.uri.edu/courses/ele205/Arduino%20-%20Learning.pdf
[13] Arduino Microcontroller Guide http://www.me.umn.edu/courses/me2011/arduino/arduinoGuide.pdf [14] Arduino functions http://playground.arduino.cc/Code/Function
[14] Structuring Your Code into Functional Blocks https://www.inkling.com/read/arduino-cookbook-michael-margolis-2nd/chapter-2/recipe-2-10
[15] Arduino programming Problem solution http://stackoverflow.com/questions/12975895/arduino-argument-of-type-void-classname-does-not-match-void-whi
[16] Blink Without Delay http://arduino.cc/en/Tutorial/BlinkWithoutDelay
[16a] Operating Two Servos with the Arduino http://www.robotoid.com/appnotes/arduino-operating-two-servos.html
[17] Servo Problems With Arduino http://rcarduino.blogspot.com/2012/04/servo-problems-with-arduino-part-1.html
[18] Problem with arduino servo http://electronics.stackexchange.com/questions/93746/problem-with-arduino-servo
[19] Arduino Servo control problem, external servo power source https://forum.sparkfun.com/viewtopic.php?f=32&t=24263
[20] Problem with multi servos on Arduino http://www.youtube.com/watch?v=iZFO_8hH7QY
[21] Multiple servo control http://www.instructables.com/id/Serial-Servo-Controller-wAduino-Control-Up-To-1/
[22] Flex sensor http://mech207.engr.scu.edu/SensorPresentations/Jan%20-%20Flex%20Sensor%20Combined.pdf
[23] Arduino map() method http://stackoverflow.com/questions/9024124/arduino-map-method-why
[24] Arduino programming tutorial http://opensourcehardwaregroup.com/tutorial-09-reading-analog-pins-and-converting-the-input-to-a-voltage/
[25] Calibration of flex sensors http://www.mtbs3d.com/phpBB/viewtopic.php?f=138&t=17799
[26] Sensing A Bend With A Flex Sensor + Arduino http://bildr.org/2012/11/flex-sensor-arduino/
[27] Arduino tutorial PWM http://www.youtube.com/watch?v=Y1QraI5i_XM
[28] MPU 6050 by Jeff Rowberg https://github.com/jrowberg/i2cdevlib

AUTHOR PHOTOS AND BIOGRAPHY

Mr. Kattimani H.D.
HoD EEE Department, BMSIT College

Updesh Kumar Sharma
EEE Department;8th SEM,BMSIT College

Naveen R.G.
EEE Department;8th SEM;BMSIT College

Shashank Chauhan
EEE Department, 8th SEM, BMSIT College

Roy Varghese
EEE Department,8th SEM,BMSIT College

International Journal of Engineering Research-Online
A Peer Reviewed International Journal
Email:editorijoer@gmail.com http://www.ijoer.inISSN: 2321-7758
Vol.5., S1., June 2017
NCETAR - 17
CATEGORY: EEE

Solar Based Design and Development of Time Operated Spikes for Traffic Signals

[1]ABRAHAM GEORGE, [2]PADMASHREE B N, [2]NIRANJAN J M, [2]KAVITHA P, [3]ASHWINI A M
Department of Electrical and Electronics, M S Engineering College, Bengaluru, India.
[1]george.ab2008@gmail.com;[2]prashasthi.padmashree@gmail.com;[2]niranjan.jme@gmail.com
[2]kavitha8996@gmail.com; [3]amashu.alur@gmail.com

ABSTRACT
It is a known fact that due to industrialization the production of vehicles has increased leading to problems of traffic congestion and accidents leading to delays in arrival for employment, education and meetings. This paper aims the enforcement of traffic rules in urban areas. The setup is made up of sharp spikes placed in a row. The tyres of the automobiles are punctured if they try to trespass a traffic signal. The mechanism used for the lifting and retreating of spikes is microcontroller based which consists of a jack, a wiper motor and other auxiliary equipments.

I. INTRODUCTION

A. *Necessity of the System*

Citizens living near densely populated areas are not new to the problem of traffic congestion. People are also familiar with the time, energy and patience required in order to survive traffic congestion. This stresses the need for the regulation of traffic flow. It can be easily observed that if the vehicles are allowed to move in any direction, there are high chances of one of them blocking the other coming from the opposite direction hence resulting in a traffic jam. To avoid this, traffic signals are introduced which helps in delimiting the vehicles which otherwise may result in traffic jams. There are many other traffic rules that help reduce the problem of conflicting vehicles such as agreeing upon which side of the road the vehicles are to drive (left or right); traffic lanes which marks a boundary within which the cars must be driven hence preventing the consumption of unnecessary road space.

B. *Reasons for Traffic Congestion*

Traffic congestion occurs when the bulk of the traffic is more than the saturation level of the road. There are a few situations that instigate or exaggerate the congestion. These situations occur when the capacity of the road is lessened at some point or over a certain distance or when there is redundance of vehicles for a given number of passengers. The majority of the traffic is caused due to weight of the traffic and the rest due to road work, incidents and weather conditions. It is observed that even small individual vehicle incidents could cause ripple effect which then advance to form a traffic jam.

C. *Problems Posed*

Traffic congestion results in time squandering of traveler. It also causes setbacks and result in late arrival for employment, meetings etc.

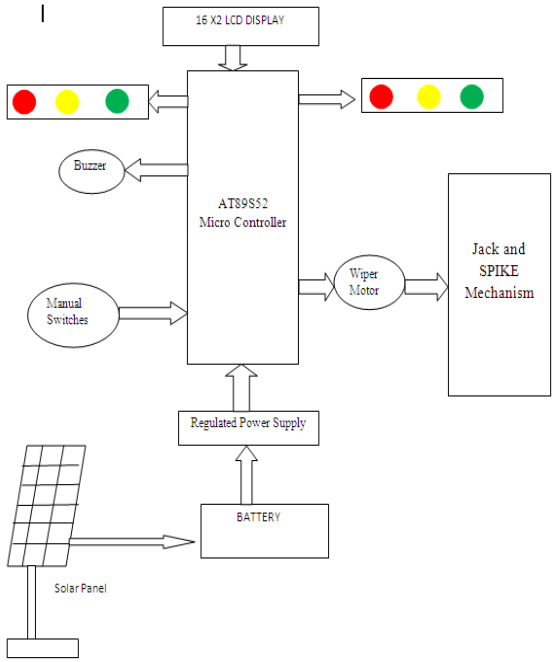
Inefficiency in predicting the forecast time results in less productive time for drivers. The fuel that is wasted also results in air pollution and wastage of fuels. The vehicle will suffer wear and tear due to sudden acceleration and breaking operation imposed on them. Traffic congestion also stresses out the motorists reducing their mental and physical health. Also blocked traffic may interfere with the passage of the emergency vehicles such as ambulance and police vans. The chances of collision are high due to reduced space between vehicles in a traffic jam.

To minimize these problems traffic signal synced spike system can be developed. The arrangement is made up of sharp spikes placed in

sequel and it is synced to the traffic signal such that it punctures the tires of the vehicles if they try to trespass a traffic signal. In this paper the materials used and the working of such a system is presented.

II. CONSTRUCTION AND WORKING

A. Construction



.Fig.1 The Block Diagram of the Traffic Spike Mechanism

Components used: wiper motor, jack, LED display, siren, serial spike arrangement, microcontroller, relays and other auxiliary equipment.

The model consists of a jack upon which the spike arrangement is fitted. The lead of the jack is connected to a wiper motor whose rotary motion is utilized to expand and compress the jack. The motor is supplied to by a battery powered by a solar cell.

The motor, the siren and the LED display are synchronized to the traffic signals by a microcontroller (ATS952). Manual switches are provided to control the spikes in cases of emergency. The motor is connected to a pair of relay to facilitate forward and backward motoring operation.

B. Functioning requirement:

The main functions required by this system is explained as follows:

1) *When the signal is green:* The vehicles move normally. The LED displays signal which shows it is safe for the vehicles to move.

2) *When the signal turns from green to yellow:* A warning signal is displayed indicating the emergence of spikes in a short while. A siren is also sounded as an auxiliary warning.

3) *When the signal turns from yellow to red:* the spikes emerge from the surface of the road as soon as the timer of the red signal starts. The emergence of the spikes consumes an interval of about two seconds.

4) *When the signal turns from red to yellow:* The spikes begin to retreat back into the road surface. This action takes up about two seconds.

5) *When emergency vehicles arrive:* The spikes are made to retrieve manually using a switch provided for the purpose.

C. Working: As the timer of the traffic signal turns yellow from green, the microcontroller signals the siren and the LED displays warning.

The timer provided for the traffic signal is programmed to trigger the relays. The initiation of the timer of the red signal makes the motor to be connected in a polarity that makes it rotate in a clockwise direction. This motion turns the lead of the jack lifting the spikes from the road surface.

As the timer of the red signal terminates and the yellow signal initiates, the relays are programmed to reverse the polarities of the motor causing the motor to rotate in an anti clockwise direction, hence retreating the spikes into the road surface.

Upon the initiation of the green signal the LED display is programmed to display a safe signal indicating the safety of the vehicles to move.

Two switches are provided at the terminals of the relay for operating the spike mechanism manually in cases of emergencies.

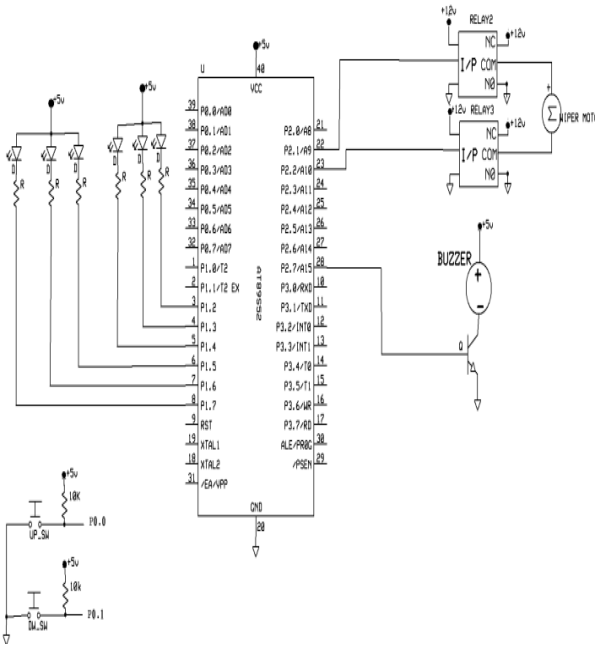


Fig.2 The Circuit Diagram of the Traffic Spike Mechanism

III. FLEXIBILITY

The idea of a spike arrangement used for traffic law enforcement can be implemented for many other areas with slight modifications as follows

A. Border Security Areas: In defense border areas the vehicles are to be inspected before passing, this spike arrangement can be implemented. The only modification required is the removal of the microcontroller unit and addition of a manual switch or RF, for convenience in operation of the mechanism at will.

This method for using spikes for halting vehicles is already in practice. Road spike strips are used which needs to stretched manually each time a vehicle is sited. This is a time and energy consuming task.

Fig.3 The Road Spike Strips.

B. One Way Traffic: The spike system can also be implemented for restricting the vehicles to travel in the right direction on one way roads. the spikes provided here do harm the vehicles travelling in the right way. They will be punctured only if travelled in the wrong direction.

Fig.3 The One-Way Road Spike Mechanism.

III. CONCLUSION

At the origin of the paper, the road spike system had been selected as the suitable design for solving the problem at hand. The paper is successfully concluded and the result is the development of an efficient and novel system that satisfies the required demands. The facet of our paper was to reduce the traffic congestion problem and regulate the ethics of citizens to comply with the traffic rules.

Thus it can be concluded that our paper is beneficial for the overall development of the society.

REFERENCES

[1]. Sanket Nandlal Bhansali "Development of Mechanism fot the Road Spike System" in IJERT, 2015, ISSN: 2278-0181.

[2]. Payal Gupta,Dhananjay V. Gadre, Tarun Kumar Raw, "Real Time Traffic Light Control System",2014, pp. 505-510.

[3]. (2005) roadtraffic-technology website [online]. Availible: http://www.roadtraffic-technology.com/

[4]. (2017) speedway motors website [online]. Availible: http://www.speedwaymotors.com/

[5]. (2012) sunstore solar power solution website [online]. Availible: https://www.sunstore.co.uk/home.php

[6]. (2015) CircuitDigest website [online]. Availible: https://circuitdigest.com/

International Journal of Engineering Research-Online
A Peer Reviewed International Journal
Email:editorijoer@gmail.com http://www.ijoer.inISSN: 2321-7758

Vol.5., S1.,
June 2017

NCETAR - 17

CATEGORY: EEE

Controlling Techniques for DC Motor Using Four quadrant Operation

[1]VANDANA,[2]KMENHUNLANG L MARSHILLONG,[2]PRAVEEN,[2]SAINDURLANG NONGRANG,[2]SHIVARAJ,[3]ABRAHAM GEORGE

Department of Electrical and Electronics, M S Engineering College, Bengaluru, India.
[1]vandana.ask@gmail.com; [2]kmenlang80@gmail.com; [2]pavip71062@gmail.com;
[2]Sainnongrang1@gmail.com,[2]shivarajdanddoti@gmail.com; [3]hod.eee@msec.ac.in

ABSTRACT

The electric drive systems used In Industrial applications are increasingly required to meet higher performance and reliability requirements. The DC Motor is an attractive piece of equipment in many Industrial applications requiring variable speed and load characteristics due to its ease of controllability. Microcontrollers provide a suitable means of meeting these needs. In this paper, Implementation of the AT89s52 Microcontrollers for speed control of DC motor fed by a DC chopper has been investigated. The chopper is driven by a high frequency PWM signal. Controlling the PWM duty cycle is equivalent to controlling the motor terminal voltage, which In turn adjust directly the motor speed. The paper is designed to develop a speed control system for a DC motor using microcontroller AT89s52. The motor is operated in four quadrants i.e. clockwise; counter clock-wise, forward brake and reverse brake. It also has a feature of speed control.

Keywords: DC Motor, Microcontroller, Speed Control, PWM, L293D.

I. INTRODUCTION

The use of power electronics for the control of electric machines offers not only better performance caused by precise control and fast response, but also maintenance, and ease of implementation. In this project we are controlling speed of DC motor. As we increase the speed of DC motor as a result an increase in the productivity of material. The application of this is used in domestic's purpose examples are hair dryer, mixer, zero machine, elevator and industrial purpose examples are traction and elevator. In this paper we have control the actual speed of dc motor as per our requirement. This can be achieved through PIC microcontroller. The microcontroller computes the actual speed of the motor by sensing the terminal voltage and displayed on LCD. In this paper firstly we are giving the supply to PIC AT89s52 microcontroller. Then controller generates the pulse generally 5VDC.The generated pulse is nothing but PWM signal, which is given to the driver circuit. The function of this driver circuit is to generate 12V DC pulse. This is necessary to switch/trigger the IGBT. Thus the speed of BLDC motor is controlled through duty/PWM cycle. This PWM pulse is given to IGBT for triggering purpose. The Design & Implementation of this paper is done through the software. It then compares the actual speed of the motor with the reference speed and generates a suitable control signal which is fed into the triggering unit. This unit drives a Power IGBT amplifier, which in turn supplies a PWM voltage to the dc motor.

Let us consider a simple circuit that connects a battery as power supply through a switch IGBT as shown in Figure 2. When the switch is closed, the motor sees 12 Volts, and when it is open it sees 0 Volts. If the switch is open for the same amount of time as it is closed, the motor will see an average of 6 Volts, and will run more slowly accordingly. This on-off switching is performed by power IGBT. An IGBT (Metal-Oxide-Semiconductor Field Effect Transistor) is a device that can turn very large

currents on and off under the control of a low signal level voltage.

The average of voltage that supply to DC motor is given by, Vavg = (ton / T) * Vin Where Vavg = average voltage supply to DC motor The hardware of the microcontroller includes mainly the AT86C51 system with LCD and keypad for user interface. Changing the terminal voltage by means of DC to DC chopper (the power circuit) that is controlled by the microcontroller generated PWM signal controls the speed of the motor. The motion of a DC motor is controlled using a DC drive. DC drive changes the speed and direction of motion of the motor. Some of the DC drives are just a rectifier with a series resistor that converts standard AC supply into DC and gives it to the motor through a switch and a series resistor to change the speed and direction of rotation of the motor. But many of the DC drives have an inbuilt microcontroller that provides programmable facilities, message display on LCD, precise control and also protection for motors. Using the DC drive you can program the motion of the motor, i.e., how it should rotate.

Here are some of the features of this DC motor controller:-

1. Controlled through microcontroller AT 89S52.
2. Message displayed on the LCD module.
3. Start, stop and change of direction of the motor controlled by pushbutton switches and indicated by LED.
4. Changes the running mode of the motor to continuous, reversible or jogging.
5. Changes the speed of the motor.
6. Time settings are possible for forward and reverse running of the motor.

II .FOUR QUADRANT CHOPPER

Chopper is used for conversion of fixed DC into variable DC. Operation of four quadrant chopper is shown in figure1. In the first quadrant operation power can be flow from source to load and hence, current and voltage in the first quadrant are assumed to be positive. Similarly, in second quadrant operation voltage remain positive but change in direction of current i.e. negative this condition happened when load is inductive such as a DC motor in third quadrant operation current and the voltage are both in negative but the power is positive. Similarly in four quadrant operation current is positive and voltage is negative and therefore power is negative which is shown in Figure1.

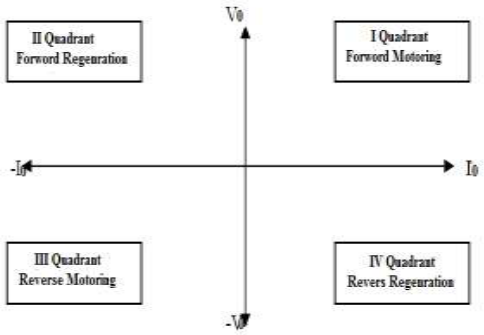


Figure.1 Basic operation of four quadrant chopper

At the first quadrant current and voltage are positive then the motor can rotate in the forward direction i.e. forward motoring. If the polarity of armature current and armature voltage changing then the motor can operated as reveres motoring i.e.(III Quadrant) and when direction of energy is reveres in II and IV Quadrant the motor can operated as a generator braking. The chopper will give the facility of regenerative braking. There generative braking is cause when the energy can return to the supply and the main condition for the regenerative braking is that Emf produced by the motor which is rotating Emf it must be greater than the applied voltage so that can be flow in the reverse direction the motor can operated at generating mode. The generating mode can be maintained over any particular duration of time only if the load is able to delivered power. Four quadrant operation can be described by the circuit which is show in below Figure 2.

Four quadrant operations can be carried out by the four switching devices with the diode connected in anti-parallel with switching diode, the motor is connected between the two arm A and B.

a) First Quadrant:When the supply is given to the circuit the T1 andT4 is ON, current flowing through the path, (Vdc+) -T1 – Load (A-B) - T4 – (Vdc-). hence both current and voltage are positive. During this condition the inductance get charge by positive polarity. The first quadrant operation can be achieved.

b) Second Quadrant: When T2 and T3 are turned-on current start to flow through path (Vdc+) – T3 – Load (B-A) –T2 – (Vdc-), the current and voltage are negative. the second quadrant operation can be achieved. The inductor get charge again with the same polarity.

c) Third Quadrant: During third quadrant operation inductor get fully charge it find path to get discharge during discharge the energy can dissipated through Load(B) – D1 – (Vdc+) – (Vdc-) – D4 – Load(A)since the voltage is positive and current is negative and second quadrant operation can be achieved.

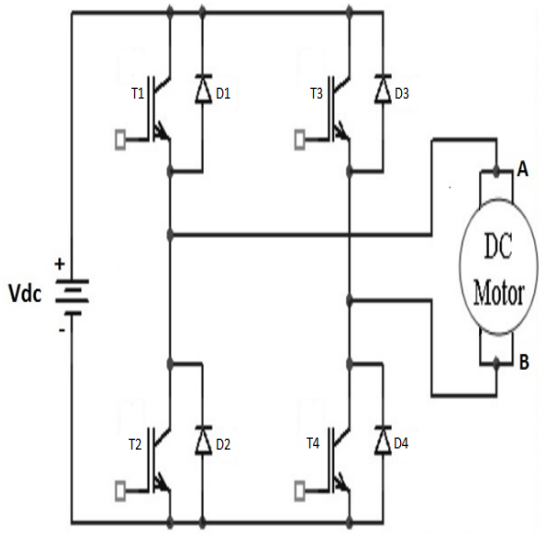


Figure.2 Circuit Diagram Of four quadrant Chopper

d) Fourth Quadrant: During first quadrant operation inductor get fully changed it will find the path to discharge for that inductor change the polarity and get discharge through path Load(B) - D3 –(Vdc+) – (Vdc -) – D2 – Load(A) in that case voltage negative and current is positive the fourth quadrant operation can be achieved. If we consider the power in the electrical system is given below

Po= Vo * Io (1)

Where, Po=Output power in the circuit

Vo=Output voltage

Io= Output current

This gives the result that the system can allow the power flow in both direction while reversing the current and changing the polarity of the voltage, that way motor operated in both direction.

III. BLOCK DIAGRAM

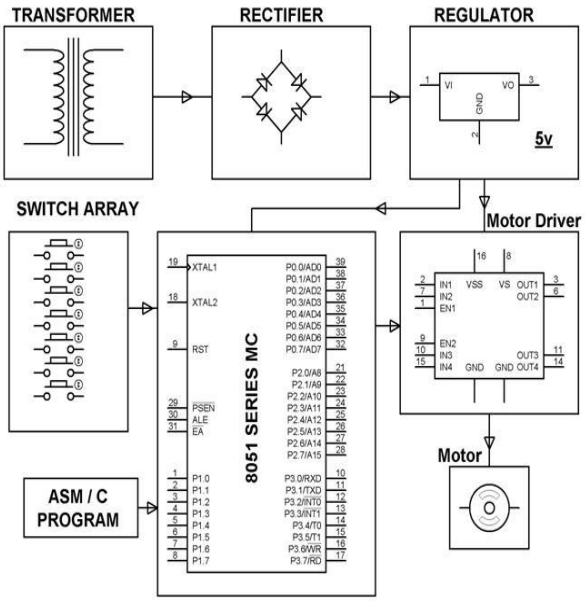


Figure.3 Block Diagram For the Controlling Operation Of DC Motor

Hardware Requirements

89s52 Microcontroller, Crystal, DC Motor, Motor Driver IC,LED, Resistors, Capacitors, Diodes, Transformer, Voltage Regulator, Push Buttons

Software Requirements

Keil compiler

Language: Embedded C or Assembly

III. RESULT AND DISCUSSION

The eight pushbutton switches are connected for eight different functions as – When S1 is pressed, the microcontroller sends low logic to port pin P2.5. The high output of inverter N2 drives transistor T1 into saturation and relay RL1 energises. So the output of NE555 is fed to inputs IN1 and IN2 of L293D through both the contacts of relay RL2. Now at the same time, after RL1 energises, the microcontroller starts generating PWM signal on port pin P2.4, which is fed to trigger pin2 of NE555 through inverter N3. The base frequency of the generated PWM signal is 500 Hz, which means the time period is 2 ms (2000µs). The output pulse width varies from 500 µs to 1500 µs. The R-C time constant of the monostable multivibrator is kept slightly less than 500 µs to generate exactly the same inverted PWM as is generated by the microcontroller. When switch S2 is pressed, port-pin P2.5 goes high and RL1

de-energises to stop the motor. When switch S3 is pressed, relay RL2 energises. Pin IN1 of motor driver L293D receives the PWM signal and pin IN2 connects to ground. As a result, the motor rotates in one direction (say, clockwise). When switch S4 is pressed again, relay RL2 de-energises. Pin IN2 of motor driver L293D receives the PWM signal and pin IN1 connects to ground. The motor now rotates in opposite direction (anti-clockwise). When switch S3 is pressed, different modes are selected in cyclic manner as given below: 1. Continuous mode. The motor rotates continuously with the set speed in either direction 2. Reversible mode. The motor reverses automatically after the set time 3. Jogging mode. The motor rotates for the set time in either direction and then stops for a few seconds and again rotates for the set time. It is also called 'pulse rotation' Switches S5 and S6 are used to set the speed of the motor, either in increasing order or decreasing order, in continuous mode only. Switches S7 and S8 are used to set the time either in increasing order or decreasing order.

IV. CONCLUSION

The goal of this paper is to design a DC motor speed control system by using microcontroller AT89S52. It is a closed-loop real time control system. The controller will maintain the speed at desired speed when there is a variation of switch. By varying the PWM signal from microcontroller to the motor driver, motor speed can be controlled back to desired value easily

REFERENCES

[1]. Y.S.E.Ali, S. B. M. Noor, S. M. Uashi and M. K Hassan" Microcontroller Performance for DC Motor Speed Control" O-7803-8208©2003 IEEE.

[2]. Pierre Guillemin "Fuzzy Logic Applied to Motor Control" IEEE TRANSACTIONS ON INDUSTRY APPLICATIONS, VOL. 32, NO. 1, JANUARYIFEBRUARY 1996.

[3]. Yodyium Tipsuwan, Mo-Yuen Chow "Fuzzy Logic Microcontroller Implementation for DC Motor Speed Control" O-7803-8208©1999 IEEE.

[4]. Singariv.s.r Pavankumar,Sande.krishnaveni, Y.B.Venugopal, Y.S.Kishore Babu, "A NeuroFuzzy Based Speed Control of Separately Excited DC Motor", IEEE Transactions on Computational Intelligence and Communication Networks, pp. 93- 98, 2010.

[5]. Moore, A.W. Phase-Locked Loops for Motor-Speed Control. IEEE Spectrum, April 1973. 61-67.

International Journal of Engineering Research-Online
A Peer Reviewed International Journal
Email:editorijoer@gmail.com http://www.ijoer.inISSN: 2321-7758
Vol.5., S1., June 2017
NCETAR - 17
CATEGORY: EEE

Power Generation Using Human Footstep

PRIYANKA RANI[#1], ROMA KUMARI[*2], BHUBAN KUMAR MAHTO[#3], Dr.ABRAHAM GEORGE[*4],ROHIT P K[#5]
Department of Electrical and Electronics, M S Engineering College, Bengaluru,India
[1]priyankakhatrii101@gmail.com;
[2]romakumari833@gmail.com,[3]kumar.bhuban15@gmail.com,[*4]rohithraghuthaman@gmail.com
[#5]george.ab2008@gmail.com

ABSTRACT
This paper is all about generating electricity when people walk on the floor. Nowadays energy and power are the basic necessities regarding this modern world. As the demand of energy is increasing day by day, the ultimate solution to deal with these sorts of problems is just to generate electricity with the help of renewable energy sources. The objective of this work is power generation through footsteps as a source of renewable energy that can be obtained while walking through footpaths, stairs etc. With the help of a special arrangement which is in plate form. These systems can be installed specially in the dense populated areas like schools, colleges, bus stops, railway stations, shopping malls etc. As a result of completing the above procedure or technique we made ourselves able to design such compatible system through which we could run our lighting system because the lighting system is one of the major components which consumes 60% of electricity in our day to day life. Our main purpose is to charge the battery through DC output and store its energy for lighting purpose. There are two ways in which charging is done, one is through piezoelectric plates and the other using solar panel. Both can improve the efficiency of the system, thus avoiding wastage.

I. INTRODUCTION
Man has needed and used energy at an increasing rate for his purpose. Due to this a lot of energy resources have been exhausted and wasted. The utilization of waste energy of foot power with human locomotion is very much relevant for highly populated countries where the roads, railway stations, bus stands, temples, etc.

The human bio-energy being wasted if it can be made possible for utilization it will be very useful energy sources. Walking is the most common activity in day to day life. While walking, the person loses energy to the surface in the form of vibration. This energy can be tapped and converted to electrical form. In this paper, piezoelectric crystals were used as a medium. These piezoelectric crystals convert the mechanical vibrations into electrical energy.

II. DESIGN CONSTRAINTS
The following are the design constraint:

1.A **piezoelectric sensor** is a device that uses the piezoelectric effect, to measure changes in pressure, acceleration, temperature, strain, or force by converting them to an electrical charge.

2.Battery: Battery consists of electrochemical cells to store electricity house in a single unit. In battery stored chemical energy is transformed into electrical energy. Some batteries are used once and some of them are rechargeable. Large batteries also provide stand by operation i.e. mobile, laptops etc.

3.Multimeter : A multimeter or a multitester, also known as a VOM (Volt Ohm millimeter), is an electronic measuring instrument that combines several measurement functions in one unit. A typical multimeter can measure voltage, current and resistance. Analog multimeters use a microammeter with a moving pointer to display readings. Digital multimeters (DMM, DVOM) have a numeric display, and may also show a graphical bar representing the measured value.

III. METHODOLOGY

One of the most suitable methods for obtaining the energy surrounding a system is achieved by using piezoelectric crystals. Piezoelectric crystals are one of small scale energy sources. The piezoelectric crystals are subjected to vibration they generate a very small voltage, commonly known as piezoelectricity. It has a crystalline structure that converts an applied vibration into an electrical energy .The piezoelectric effect exists in two properties:

The first is the direct piezoelectric effect that describes the material's ability to transform mechanical strain into electrical charge.

The second form is the converse effect, which is the ability to convert an applied electrical potential into mechanical strain energy. These properties allow the material to function as a power harvesting medium.

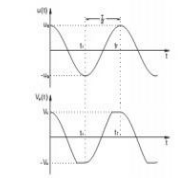


fig.1 Typical waveforms of displacement u(t) and piezo voltage vP(t) for ac-dc power harvesting circuit

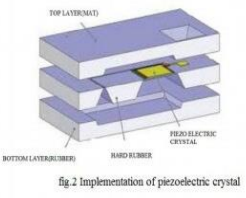


fig.2 Implementation of piezoelectric crystal

Fig.1 Assembly of frame

Due to the vibrations, piezoelectric crystals generate the electrical power. The produced output voltage is in the form of AC. Then it can be converted to DC by passing it through Rectifier circuit. The converted DC voltage can be fed into Boost converter.

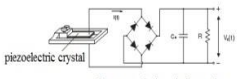


fig.3 A Typical ac-dc harvesting circuit

BOOST CONVERTER

A boost converter (step-up converter) is a power converter with an output DC voltage greater than its input DC voltage. It is a class of switching-mode power supply (SMPS) containing at least two semiconductor switches (a diode and a transistor) and at least one energy storage element. Filters made of capacitors (sometimes in combination with inductors) are normally added to the output of the converter to reduce output voltage ripple. The schematic for boost converter is shown in the fig.4

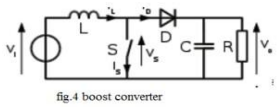
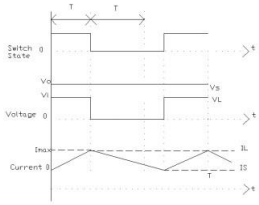


fig.4 boost converter

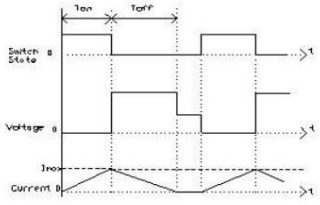
The basic principle of a Boost converter consists of two Modes of operations:

Continuous mode : In the On-state, the switch S (see fig.4) is closed, resulting in an increase in the inductor current. When a boost converter operates in continuous mode, the current through the inductor (IL) never falls to zero. Figure 4.1shows the typical waveforms of currents and voltages in a converter operating in this mode.



4.1 Waveforms of voltage and current in discontinuous mode

Dis-Continuous mode: In the Off-state, the switch is open and the only path offered to inductor current is through the flywheel diode D, the capacitor C and the load R. This result in transferring the energy accumulated during the On-state into the capacitor. In some cases, the amount of energy required by the load is small enough to be transferred in a time smaller than the whole commutation period. In this case, the current through the inductor falls to zero during part of the period.



4.2 Waveforms of voltage and current in discontinuous mode

Power delivery: PWM can be used to reduce the total amount of power delivered to a load without losses normally incurred when a power source is limited by resistive means. This is because the average power delivered is proportional to the modulation duty cycle. With a sufficiently high modulation rate, passive electronic filters can be used to smooth the pulse train and recover an average analog waveform. High frequency PWM

power control systems are easily realisable with semiconductor switches. The discrete on/off states of the modulation are used to control the state of the switch (es) which correspondingly control the voltage across or current through the load. The major advantage of this system is the switches are either off and not conducting any current, or on and have (ideally) no voltage drop across them. The product of the current and the voltage at any given time defines the power dissipated by the switch, thus (ideally) no power is dissipated by the switch. Realistically, semiconductor switches such as MOSFETs or BJTs are non-ideal switches, but high efficiency controllers can still be built.

PWM is also often used to control the supply of electrical power to another device such as in speed control of electric motors, volume control of Class D audio amplifiers or brightness control of light sources and many other power electronics applications. For example, light dimmers for home use employ a specific type of PWM control. Home use light dimmers typically include electronic circuitry which suppresses current flow during defined portions of each cycle of the AC line voltage. Adjusting the brightness of light emitted by a light source is then merely a matter of setting at what voltage (or phase) in the AC cycle the dimmer begins to provide electrical current to the light source (e.g. by using an electronic switch such as a triac). In this case the PWM duty cycle is defined by the frequency of the AC line voltage (50 Hz or 60 Hz depending on the country). These rather simple types of dimmers can be effectively used with inert (or relatively slow reacting) light sources such as incandescent lamps, for example, for which the additional modulation in supplied electrical energy which is caused by the dimmer causes only negligible additional fluctuations in the emitted light. Some other types of light sources such as light-emitting diodes (LEDs), however, turn on and off extremely rapidly and would perceivably flicker if supplied with low frequency drive voltages. Perceivable flicker effects from such rapid response light sources can be reduced by increasing the PWM frequency. If the light fluctuations are sufficiently rapid, the human visual system can no longer resolve them and the eye perceives the time average intensity without flicker.

Voltage Regulation: PWM is also used in efficient voltage regulators. By switching voltage to the load with the appropriate duty cycle, the output will approximate a voltage at the desired level. The switching noise is usually filtered with an inductor and a capacitor. One method measures the output voltage. When it is lower than the desired voltage, it turns on the switch. When the output voltage is above the desired voltage, it turns off the switch.

POWER SUPPLY: The power supply required for the microcontroller is obtained from the source and is regulated to +5V (shown in fig4.6.1)for the proper functioning of the microcontroller. this is achieved by means of using a regulator IC 7805.Similarly another voltage regulator IC is also necessary in order to regulate the boosted voltage to +12V(shown in fig4.6.2) which is the appropriate battery voltage

IC voltage regulators: Voltage regulators comprise a class of widely used ICs. Regulator IC units contain the circuitry for reference source, comparator amplifier, control device, and overload protection all in a single IC. IC units provide regulation of either a fixed positive voltage, a fixed negative voltage, or an adjustably set voltage. The regulators can be selected for operation with load currents from hundreds of milli amperes to tens of amperes, corresponding to power ratings from milli watts to tens of watts.A fixed three-terminal voltage regulator has an unregulated dc input voltage, Vi, applied to one input terminal, a regulated dc output voltage, Vo, from a second terminal, with the third terminal connected to ground.The series 78 regulators provide fixed positive regulated voltages from 5 to 24 volts. Similarly, the series 79 regulators provide fixed negative regulated voltages from 5 to 24 volts

BATTERY

NICKEL CADMIUM BATTERY

The nickel–cadmium battery (NiCd battery or NiCad battery) is a type of rechargeable battery using nickel oxide hydroxide and metallic cadmium as electrodes. The abbreviation Ni-Cd is derived from the chemical symbols of nickel (Ni) and

cadmium (Cd): the abbreviation NiCad is a registered trademark of SAFT Corporation, although this brand name is commonly used to describe all Ni–Cd batteries. Wet-cell nickel-cadmium batteries were invented in 1898.A NiCd battery has a terminal voltage during discharge of around 1.2 volts which decreases little until nearly the end of discharge. Ni-Cd batteries are made in a wide range of sizes and capacities, from portable sealed types interchangeable with carbon-zinc dry cells, to large ventilated cells used for standby power and motive power. Compared with other types of rechargeable cells they offer good cycle life and capacity, good performance at low temperatures, and work well at high discharge rates (using the cell capacity in one hour or less). However, the materials are more costly than types such as the lead acid battery, and the cells have higher self discharge rates than some other types. Sealed Ni-Cd batteries require no maintenance. Sealed Ni-Cd cells were at one time widely used in portable power tools, photography equipment, flashlights, emergency lighting, and portable electronic devices. The superior capacity of the Nickel-metal hydride batteries, and more recently their lower cost, has largely supplanted their use. Further, the environmental impact of the disposal of the heavy metal cadmium has contributed considerably to the reduction in their use. Within the European Union, they can now only be supplied for replacement purposes although they can be supplied for certain specified types of new equipment such as medical devices. Larger ventilated wet cell Ni-Cd batteries are used in emergency lighting, standby power, and uninterruptible power supplies and other applications.

IV.CONCLUSION

The project is successfully tested which is the best economical, affordable energy solution to common people. This can be used for many applications in city areas where want more power. Bangladesh is a developing country where energy management is a big challenge for huge population. By using this project. I can drive D.C loads according to the force I applied on the piezo electric sensor. Although the theory developed in this report justifies the use of switching techniques in efficiently converting that energy to a usable form, there are obviously some practical limitations to the systems presented. The final prototype design does fulfill the objective of generating electricity from piezoelectric disk. Due to the low cost design of the piezoelectric system it is a practical product which could increase the operating period of most common products. The data collected is capable of extending the operational lifespan per charge of portable electronic devices. Although the theory developed in this report justifies the use of switching techniques in efficiently converting that energy to a usable form, there are obviously some practical limitations to the systems presented. Measurements of source current into the primary and load current transferred from the secondary reveal that very little current gain truly occurs between the input and output ports of the switch in the forward converter hybrid. Further, similar results were encountered when one examines the energy transferred through the series switch and inductor in the buck converter. In addition, based on the results gathered in this investigation, the final prototype design does fulfill the objective of generating electricity from piezoelectric disk. Due to the low cost design of the piezoelectric system it is a practical product which could increase the operating period of most common products. The data collected is capable of extending the operational lifespan per charge of portable electronic devices.

REFERENCES

1. International Journal of Scientific and Research Publications, Volume 3, Issue 3, March 2013 1 ISSN 2250-3153
2. International Journal of Engineering and Innovative Technology (IJEIT) Volume 3, Issue 10, April 2014
3. Richard, Michael Graham, (2006-08-04). "Japan: Producing Electricity from Train Station Ticket Gates". Tree Hugger. Discovery Communications, LLC.
4. IEEE Standard on Piezoelectricity, Standards Committee of the IEEE Ultra Sonic's, Ferroelectrics, and Frequency Control Society, ANSI/IEEE Std 176-1987 (1988)

International Journal of Engineering Research-Online
A Peer Reviewed International Journal
Email:editorijoer@gmail.com http://www.ijoer.inISSN: 2321-7758
Vol.5., S1., June 2017
NCETAR - 17
CATEGORY: EEE

PLC Using ARM for Industrial Automation

[1]VIDYA SHREE M, [2]ANAND PRATAP MALL, [2]ROFIKUL ISLAM, [2]JAYKUMAR, [2]AISHWARYA, [3]ABRAHAM GEORGE
Department of Electrical and Electronics, M S Engineering College, Bengaluru, India
[1]m.vidyashree18@gmail.com;[2]anandpratapmall32@gmail.com;[2]rofikuli45@gmail.com;
[2]jkphulekar@gmail.com,[2]aishu25111995@gmail.com,[3]george.ab2008@gmail.com

ABSTRACT
Automation is the basic need of industries nowadays. There are number of technologies that are growing to achieve the good automation in the plant. Among all of them one of the popular technologies is the automation using PLC and ARM. Here in this paper development of ARM7 and PLC based real-time industry automation system using internet is presented. The proposed system is having PLC, microcontroller, LCD, RJ45 and server PC. The ARM7 LPC2148 is used for monitoring and controlling unit for different parameters. The main aim of this project is to control a Machine through internet. For this purpose we are interfacing an ARM7 (32 bit Microcontroller) controller which has TCP/IP stack inbuilt. This all interfacing is being done by SPI or I2C protocol.

I. INTRODUCTION

Automation is need of any industry to control industrial machinery and processes, reducing the need for human interference. With technology growing at a fast rate, automated machine status tracking system of completely automated machine status tracking system of completely automated processes is today's need that will be used in a variety of ways to track and display machine information or status in Real-time on hand held devices with wireless technology like Zigbee/GSM/GPRS.

PROCEDURE

In industries, systems are becoming very complex. Industries system needs to test the site equipment and environmental so it can track state of system in real time . This system requires design which has to be flexible and adaptable, for that microcontroller based systems can be used. This is more reliable and provides high performance to the system. Microcontroller is very practical and successfully utilized, the conventional 8 and 16-bit Microcontroller has its deficiencies when compared with 32-bit. The ARM architecture is based on Reduced Instruction Set Computer (RISC) principles, and the instruction set and related decode mechanism are much simpler than those of micro programmed Complex Instruction Set Computers. This simplicity results in a high instruction throughput and impressive real-time interrupt response from a small and cost-effective processor core. Pipeline techniques are employed so that all parts of the processing and memory systems can operate continuously. Typically, while one instruction is being executed, its successor is being decoded, and a third instruction is being fetched from memory ARM based embedded system will be more functional, reliable, cost effective, less in size and low power consumption. Microcontroller has low speed and poor memory, so it can only execute simple control tasks.

RTOS comprises of two components, namely, "Real-Time" and "Operating System". Real-Time indicates an expectant response or reaction to an event on the instant of its evolution. The expectant response depicts the logical correctness of the result produced. The instant of the events‟ evolution depicts deadline for producing the result. Operating

System (OS) is a system program that provides an interface between hardware and application programs. OS is commonly equipped with features like: Multitasking, Synchronization, Interrupt and Event Handling, Input/ Output, Inter-task Communication, Timers and Clocks and Memory Management to fulfil its primary role of managing the hardware resources to meet the demands of application programs. RTOS is therefore an operating system that supports real-time applications and embedded systems by providing logically correct result within the deadline required. Such capabilities define its deterministic timing behaviour and limited resource utilization nature. Real time kernel is simple and stable. RTOS can cut a complex application into several mutually independent tasks based on task priority and it also has its own limitation [3]. RTOS, include the task management, task scheduling, interrupt handling etc.

Industrial application requires multiple tasks to be executed. Controlling the industrial system, processing of data, storing of the data and transmission of the data with polling technique

Require more time so use of multi-tasking is involved. When ARM processor combined with RTOS with timing constraint can be realized for the data acquisition and transmission of data. For e.g. transmission of data using Ethernet or RS-485 which requires industries standards like Modbus protocol and it will have timing constraint.

II. SYSTEM OVERVIEW

A. ARCHITECTURE: Industrial system require data acquisition for which ADC is required, DAC is required for embedded control and for data backup SDRAM is required which we will contain entire log details. To communicate with desktop computer industries require Modbus protocol so Ethernet control is required.

Server Side:

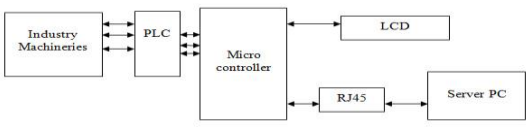
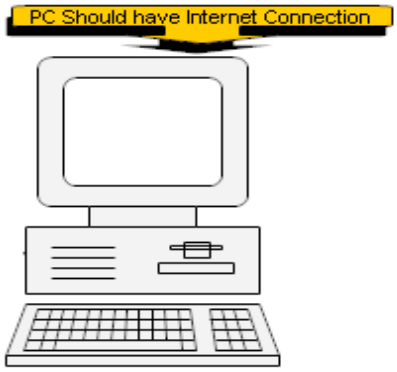
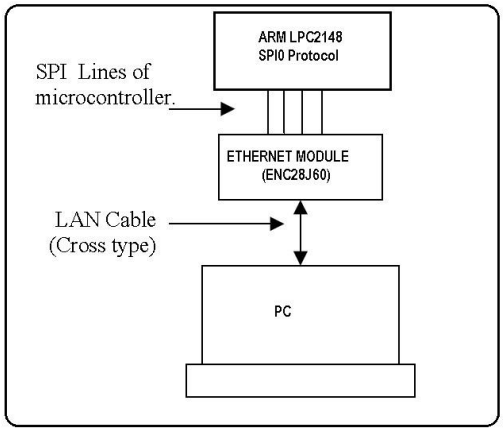


Figure 2.1: Block diagram of Proposed Architecture

Client Side:



B. ETHERNET MODULE



The ENC28J60 is a stand-alone Ethernet controller with an industry standard Serial Peripheral Interface (SPI). It is designed to serve as an Ethernet network interface for any controller equipped with SPI. The ENC28J60 meets all of the IEEE 802.3 specifications. It incorporates a number of packet filtering schemes to limit incoming packets. It also provides an internal DMA module for fast data throughput and hardware assisted checksum calculation, which is used in various network protocols. Communication with the host controller is implemented via an interrupt pin and the SPI, with clock rates of up to 20 MHz Two dedicated pins are used for LED link and network activity indication. With the ENC28J60, two pulse transformers and a few passive components are all that are required to connect a microcontroller to an Ethernet network. The embedded system in which field signal values are displayed on Web page or collected into control centre in real-time through RJ-

45 with Embedded device (equipped with SPI support) on to a network.

III. WORKING

The aim of this project is to control a Machine through internet. For this purpose we are interfacing an ARM (32 bit Microcontroller) controller which has TCP/IP stack inbuilt. This interface is done by SPI or I2C protocol.

The developed embedded board will be configured with an IP address in which the web page will be loaded and this board will be connected to internet via RJ45 connector. This board acts as a server will control all the switches of a Machine connected to this. On the other end, we need to access the web page loaded to the web server by giving the IP address configured to server. By which we can access the web page and through this web page we can control the machine connected to the server from any part of the world via internet.

Server Side:Embedded Web Server which controls the industrial machine this web server is connected to internet.

Client Side: PC connected to internet which will be used to access the web page and control the Machine on web server.

IV. IMPLEMENTATION

The heart of the system is a real-time kernel that uses pre-emptive scheduling to achieve multitasking on hardware platform. The previous sections dealt with µCOS_II porting to the application desired. This section deals with the implementation of hardware and software. Depending on the required application the number of tasks may vary. Porting of µC/OS-II we can perform simple tasks like Temperature sensor (i.e., ADC), 16x2 LCD (i.e., degree to Fahrenheit), UART (i.e., sending msg through GSM), Ethernet (i.e. to communicate with desktop PC) MMC (i.e., memory card for data backup), Thermal printer (i.e. for printing real time RTC value.

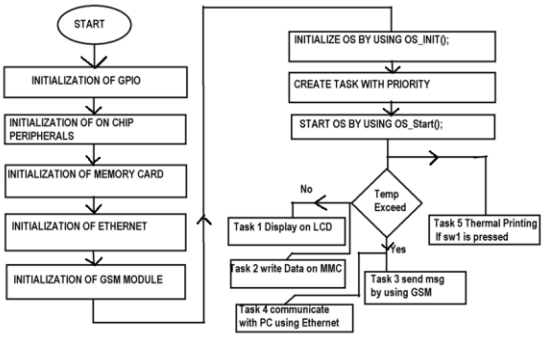


Fig.4.1 Flow chart of Hardware & µCOS_II implementation

V. SOFTWARE

Keil IDE is used for implementation. Keil IDE is a windows operating system software program that runs on a PC to develop applications for ARM microcontroller and digital signal controller. It is also called Integrated Development Environment or IDE because it provides a single integrated environment to develop code for embedded microcontroller.

Keil µVision4 IDE (Integrated Development Environment) is a Windows based front end for the C Compiler and assembler. KeilµVision4 is used for writing embedded C programs. Embedded C is a high level language, which includes many aspects of the ANSI (American National Standard Institute) C programming language. Standard libraries are altered or enhanced to address the peculiarities of an embedded target processor.

VI. CONCLUSION

The Design of ARM based industrial embedded system using RTOS offers necessary mighty functions to developing fast and efficient an application. The system can be used to perform real-time controls where there have standard electrical interface. High precision data acquisition can be realized by the embedded system as well. Using the Ethernet port of the embedded system, networked control and acquisitions can be achieved through an industrial Ethernet LAN.

The hardware and software provide a platform for diverse control and acquisition applications, including industrial process controls and factory automations. Since the embedded system is able to deal with Multi-Tasks and can run operation systems, field operations, supervisions and

managements can be done by the lower embedded devices, hence the upper PC or workstation in the industrial LAN will do fewer works, which lowers the concentration degree of the whole system. This enhances the reliability of the control and acquisition system and reduces the risks.

As per the proposed design was made and it was suitable for real-time and effective requirements, in data acquisition system in industrial environment. As the number of input to the ARM controller is limited, for industry purpose we are using the PLC controller for higher inputs/outputs In future it is possible to develop android application for automation systems with the help of internet communication.

REFERENCES

[1] Pedro Cheong, Ka-Fai Chang and Kam- Weng Tam, "Zigbee Based Wireless Sensor Network node for ultra violet Detection of Flame", IEEE Transactions on Industrial Electronics, VOL. 58, NO. 11, November 2014.

[2] Srikanth.K, Narayanaraju Samunuri, "RTOS Based Priority Dynamic Scheduling for Power Applications through DMA Peripherals", International Journal of Engineering Trends and Technology (IJETT) Volume- 4 Issue 8- August 2015

[3] Vehbi C. Gungor, Dilan Sahin, Taskin Kocak, Salih Ergut, Concettina Buccella, Carlo Cecati, And Gerhard P. Hancke, Members, IEEE "Smart Grid Technologies: Communication Technologies And Standards",IEEE Transactions On Industrial Informatics, Vol. 7, No. 4, November -2014.

[4] G.M. Sultan Mahmud Rana1, Abdullah Al Mamun Khan, Mohammad Nazmul Hoque, Abu Farzan Mitul ,"Design and Implementation Of A GSM Based Remote Home Security And Appliance Control System", International Conference On Advances In Electrical Engineering (ICAEE 2013) 19-21 December ,2014,Dhaka, Bangladesh

International Journal of Engineering Research-Online
A Peer Reviewed International Journal
Email:editorijoer@gmail.com http://www.ijoer.inISSN: 2321-7758
Vol.5., S1.,
June 2017

NCETAR - 17

CATEGORY: EEE

Flapping Wing Miniature Air Vehicle (Ornithopter)

Manjunath S Lohar[1], Mithun Reddy[2], Dr.Cyril Prasana Raj[3], Dr.Abharam George[4] Dakshayini (Asst. Prof)[5]

[1, 2]Student, [3]Professor and Dean, [4]HOD EEE Dept. [5]Lecturer (AE)
MS Engineering College, Bangalore

ABSTRACT

The fact that "the natural flying creatures are still superior in terms of manoeuvrability, lightweight and endurance "motivates to find a MAV, which mimics the flapping motion of small birds, bats or insect, to have the same advantages. Also the improving technology, for instance lightweight and robust materials and better batteries, make this task more feasible and therefor the field of research of Flapping Wing MAVs has increased remarkably over the past years. Several Flapping Wing MAVs are already developed.

Physical and Aerodynamic characteristics of the bird in flight offer benefits over typical propeller or rotor driven miniature air vehicle (MAV) locomotion designs in certain applications. A number of research groups and companies have developed flapping wing vehicles that attempt to harness these benefits. This paper is focused on mechanical design aspects of mechanisms and wings.. The discussion will be focused primarily on designs which have performed at least one successful test flight. This paper provides representative designs in each category, rather than providing a comprehensive listing of all existing designs. This paper will familiarize a newcomer to the field with existing designs and their distinguishing features. By studying existing designs, future designers will be able to adopt features from other successful designs.

Key Words: Ornithoper-Flips, Flaps and Flies like Bird.

I. INTRODUCTION

As the birds are the marvelous piece of creations, there is great inspiration for researchers that can be drawn from flying animals. Birds and other flapping fliers possess a varied flight envelope, with capabilities ranging from hovering, high speed forward flight, backward flight, perching, quick take-off, and long distance soaring requiring almost no flapping. There are over 10,000 species of birds in the world, ranging in size from less than an ounce to over forty pounds. There is great inspiration for researchers that can be drawn from flying animals. In our opinion, flapping-wing flight represents an important future segment of man-made fliers, and if mastered, a totally new set of abilities will be available for various useful applications.

II. PROCEDURE

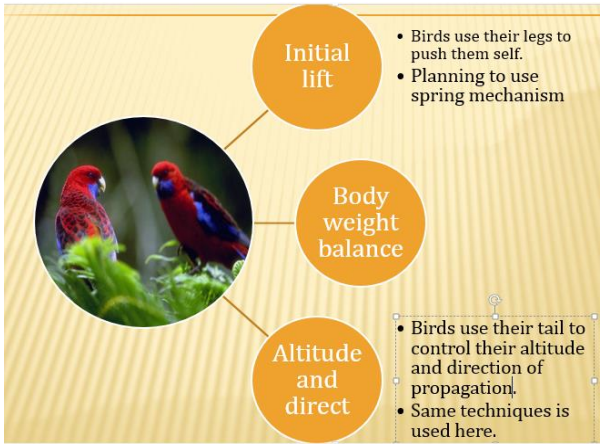
Proposed Design: Several Flapping Wing MAVs are already developed couple of them are in market but they are bit costly because of complicated design, gear mechanism and electronics used and also are bulky in size hence the proposed design provides the advantages over these existing models and also proposed design is much simpler and user friendly, it also has an option for user to build or design on their own and assemble them at any place without need of any machineries.

The proposed model can also be built using waste materials like pen refill, gears those are often found in toy cars.

Model Testing and Selection of appropriate model or design: Initially paper models are built for specific birds and are altered as per the convenient, these are passed under drop test and forced flight test, the trajectory path and behaviour of each model is recorded and are studied very carefully.

Fig(1): Models of different bird shape..

Practical Aspects to be cosidered during flight of a bird are Sufficient thurst,body weight balance,direction control etc,



Fig(2): Working procedure of a bird.

Design explanation and Implementation:

1. **Wing Design and Gear installation:**Wings is a most complicated mechanism in bird, the oscillations produced by the bird should be balanced and also weight of the body should be also balanced

The body to wings ratio of the Ornithopter is 1:3…MAVs generate the lift and thrust forces necessary for flight using flapping wings. The performance of wings depends upon the shape and compliance of the wings and the wing movement modes. The average and instantaneous thrust and lift generation strongly depends on how wings change their shapes during the flapping cycle. Several studies have been conducted to investigate aerodynamic performance of flapping wings and construct models to predict wing flight performance. These models can be used to optimize wing performance by changing spar arrangement on wings to control the wing compliance and changing the cross section shape to control lift coefficient. This area has attracted significant research attention. To keep this paper focused on the mechanical design aspects, we will not discuss aerodynamic aspects of wing design. Several different wing movement modes have been investigated to achieve flight. The most traditional functionality is with flapping wings, where flight is achieved with two flapping wings. Alternatively, four wings can be used where each side of the fuselage has a pair of wings flapping in opposite phase. This arrangement cancels out the vertical oscillations associated with two wings, resulting in more stable flight, at the expense of greater energy consumption to drive more wings. Within each category, there are variations on the basic design, such as folding wing spars, or wings that use clap-and-fling to boost lift production. Each wing style will be discussed in more detail to clarify the relative strengths and weaknesses, Mechanism is that the stresses will be much higher in the single pushrod, since it must drive both wings at the same time, in phase. In addition, the stress on the electronics components including the motor and electronic speed controller will be greater, since the wing flapping is exactly in phase. With the double crank, the wing flapping was slightly out of phase, thus distributing the load of a single flap cycle over a larger time period. While the overall work required is equivalent, the spike in loading is more focused in the single crank mechanism. It is possible to adapt the single crank mechanism to have a phase lag as with the double crank mechanism, by incorporating sliding hinges to support each wing spar. As the wings flap, the hinges that provide a fulcrum for the wings are free to move so that the motion is not jammed up at any point during the flapping motion. As a method of reducing the loading spike, a compliant frame can be used.

The general principle of operation is that by incorporating elastic links into the mechanism, spring energy can be stored and released during the flap cycle. By designing the geometry and stiffness of the system to optimize the energy storage and release, the loading range, i.e. the difference between the largest and smallest load can be reduced. Reduction in the loading range has been

shown to improve the efficiency of the mechanism, thus prolonging battery life and improving the reliability of the electronics components. This style of mechanism is used in newer versions of the University of Maryland Small Bird and Big Bird.

1. **Type of Motor used:**Type of motor that should be used depends on the required RPM and Torque, here a permanent magnet DC motor is used and the motor weigh up to 100 gr. But for bulk size servo motors and ESC are helpful.

Implementation: To have a sinusoidal flapping motion the main structure of the flapping mechanism can be approximated with a circular motion, which is generated with a rotational actuator and where the

Movement in the direction of one main axis is transmitted to the wings(refer fig 1). However in such a way, the sinusoidal motion of the wings only can be approximated.

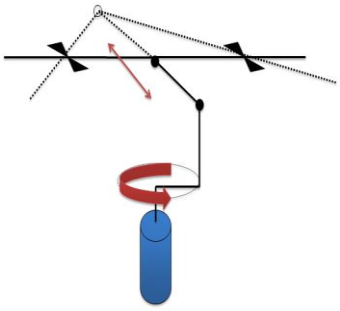
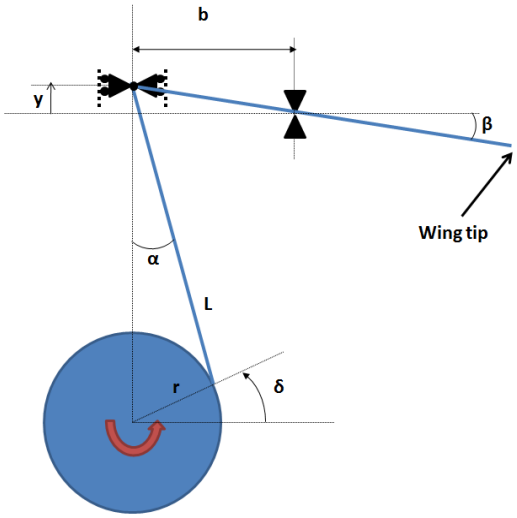
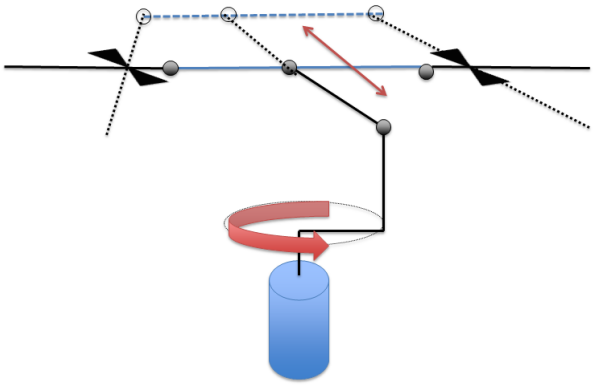


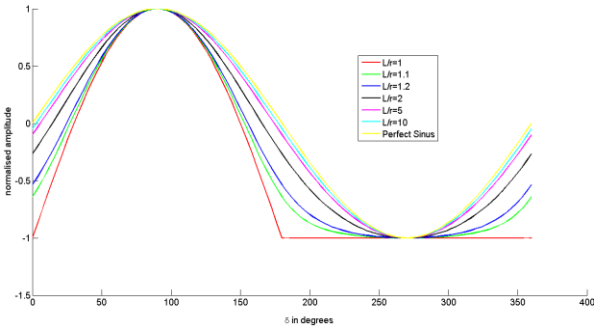
Fig (3): Schematic drawing



Fig(4): Trajectories of centred joint for one cycle for different ratios L/r



Fig(4): Trajectories of centred joint for one cycle for different ratios L/r(type B)



Equations:

$$\sin \alpha = (r*\cos \delta)/L \text{----------(1)}$$

$$y = r*\sin \delta + L*\cos \alpha \text{---------- (2)}$$

$$b = r/\tan (\beta max) \text{ ---------- (3)}$$

The resulting trajectory of the wing tip depends on the up and down(refer fig 1) movement of the centred guided joint, which again depends on the parameters L and r (refer fig 2). Only for L going to infinity a perfect sinusoidal motion with amplitude r can be achieved. For a good approximation therefor L has to be chosen much larger than r. The kinematic relationship is given with equations (1) and (2) and is shown in fig 3 for various ratios L/r1.

Already a ratio higher than 2:1 for L: r can be considered as an approximation which is good enough to achieve an acceptable sinusoidal motion. This can be either done by increasing L or decreasing r. It is important to point out, that for decreasing r, which affects the amplitude of the sinusoidal movement of the centred joint, also the distance b has to be adapted according to equation 3.3 to get the desired stroke amplitude of $\beta max = 55^{\circ}$.

To reduce this dependency of b to the amplitude r, an additional horizontal link can be

inserted according to fig(4) Instead one joint, the whole link is moved up and down and is connected over two joints to the wings to transmit this motion. Therefor the length of this link can be adjusted and assures more liberty for the later dimensioning of the different link lengths. However an additionally joint is needed, which of course reduces the efficiency.

Results and Discussion

The design of the model is very carefully designed, and the testing is performed stage wise which helped us to develop an efficient model and the same is models are as shown in the fig(5),fig(6),fig(7) and fig(8).

Fig(5): Stage 1

Explanation: Initially the basic models of various selected birds are built to test the best design taking the consideration of parameters like speed, controballity, battle ability(target) and also stability of the bird in air so as to make an integrated model which is having the properties of all the mentioned above. The models are then passed under free falling drop test and forced drop test, during the test behaviour of each model is filmed and studied later.

Fig(6): Stage 2

Explaination;

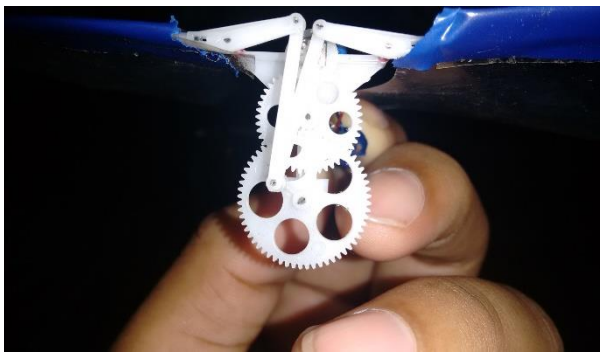
After the testing of each model and studing the response of the them a new design is designd and then a proto type is built.

Fig(7): Stage 3

Explanation: An readily available rubber band powered flapping wing vehicle is ordered and then studied it. The vehicle is de-assembled and the same gear mechanism is fabricated using 3D printer.

Fig(8): Stage 4

Explanation: Using the fabricated gears the designed model is built (Fig 8), instead of using the electronics to fly the built bird, enamelled copper wire is connected to motor and then the motor is powered by a battery.



Fig(9): Gear and motor mounting module

Fig(9): Gear and motor mounting module

Fig(10): Final Vehicle and ready to fly

III. RESULTS

By studying the properties of the various designs and properties of the bird the final model is obtained. The obtained model is light weight and less complicated in operation.

IV. CONCLUSION

The proposed model is efficient for study purpose and the model is build up by studying the unique abilities of different birds, the new model is of worth all the abilities [like; speed, stability, directional controlling etc.], hence this concludes that the aero-dynamic property of ''smaller the size of wings, greater the thrust required hence the frequency of flap should be high for which efficient PM motors with high rpm and high torque should be used also size and weight should be minimum''.

V. FUTURE APPLICATIONS

- By reducing the size the size of the vehicle it can be used for spy purpose, entertainment [fun], etc.
- Very much handy for studying aerodynamic properties of bird.
- By installing the radio controllers it can be very much efficient with long range and Arial recording.

References

[1] US Air Force Flapping Wing Micro Air Vehicle - YouTube

[2] MAV multicopter hobby project "Shrediquette BOLT", http://shrediquette.blogspot.de/p/shrediquette-bolt.html

[3] Cheng-Lin Chen and Fu-Yuen Hsiao*, Attitude Acquisition Using Stereo-Vision Methodology, presented as Paper VIIP 652-108 at the 2009 IASTED Conference, Cambridge, UK, Jul. 13-15, 2009

[4] Sen-Huang Lin, Fu-Yuen Hsiao*, and Cheng-Lin Chen, Trajectory Control of Flapping-wing MAV Using Vision-Based Navigation, accepted to present at the 2010 American Control Conference, Baltimore, Maryland, USA, Jun. 30 - Jul. 2, 2010

[5] Bug-sized spies: US develops tiny flying robots

[6] Ma, K. Y.; Chirarattananon, P.; Fuller, S. B.; Wood, R. J. (2013). "Controlled Flight of a Biologically Inspired, Insect-Scale Robot". Science. **340** (6132): 603–607. doi:10.1126/science.1231806. PMID 23641114.

[7] Graule, Moritz A.; Chirarattananon, Pakpong; Fuller, Sawyer B.; Jafferis, Noah T.; Ma, Kevin Y.; Spenko, Matthew; Kornbluh, Roy; Wood, Robert J. (May 2016). "Perching and takeoff of a robotic insect on overhangs using switchable electrostatic adhesion". Science. **352** (6288): 978–982. doi:10.1126/science.aaf1092. PMID 27199427.

[8] Honeywell Wins FAA Approval for MAV, Flying Magazine, Vol. 135., No. 5, May 2008, p. 24

[9] Mini helicopter drone for UK troops in Afghanistan

[10] https://www.gov.uk/government/news/miniature-surveillance-helicopters-help-protect-front-line-troops

[11] "Mini helicopter drone for UK troops in Afghanistan". BBC. 3 February 2013. Retrieved 3 February 2013.

[12] Benchergui, Dyna, "The Year in Review: Aircraft Design," Aerospace America, December 2009, Volume 47, Number 11, American Institute of Aeronautics and Astronautics, p. 17

[13] Michelson, R.C., "Mesoscaled Aerial Robot," Final Report under DARPA/DSO Contract Number: DABT63-98-C-0057, February 2000

[14] Michelson, R.C., "Test and Evaluation for Fully Autonomous Micro Air Vehicles," The ITEA Journal, December 2008, Volume 29, Number 4, ISSN 1054-0229 International Test and Evaluation Association, pp. 367-374

[15] Boddhu, Sanjay K., et al. "Improved Control System for Analyzing and Validating Motion Controllers for Flapping Wing Vehicles." Robot Intelligence Technology and Applications 2. Springer International Publishing, 2014. 557-567.

AUTHOR PHOTOS AND BIOGRAPHY

Manjunath S Lohar
Final Year;EEE Dept.
M.S. Engineering College,Bangalore

Mithun Reddy
Final Year,EEE Dept.M.S. Engineering College,Bangalore