

IoT Based Smart Mosquito Killing System

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Abstract: As mosquitoes are one of primary source which prompts cause terrifying maladies. Lessening the mosquito populace is progressively essential particularly in populated nation. Numerous mosquitoes cause illness like intestinal sickness, dengue and so on. So as to kill these illnesses, individuals are utilizing numerous cures like synthetic anti-agents which cause increment in circulatory strain and furthermore mental meltdown. Proposed brilliant mosquito killing framework, doesn't make any sort of mischief individuals. As this framework is innocuous to individuals as it produces ultrasonic sound waves. The recurrence scope of ultrasonic sound waves is over 20 kHz which are indiscernible to people. The ultrasonic sound rushes of recurrence scope of 40 kHz are perceptible to mosquitoes and different bugs. Whenever mosquitoes and different creepy crawlies impart, they constantly sense ultrasonic sound waves; they get aggravated and are compelled to move far from that region. This framework can be viably used to trap and obliterate mosquitoes from numerous spots like schools, parks, college's grounds and associations. Proposed framework lessens the number of inhabitants in the mosquitoes by utilizing UV light, electric fence and ultrasonic sensor. Proposed system would be worked utilizing site utilizing web. A raspberry pi alongside ultrasonic sensor, electric fence driver, and DC fan are used. In order to pull in the mosquitoes UV light is utilized alongside that automation is being executed in the proposed framework it is a cost effective approach and is portable. Proposed system will be actualized and it demonstrates that device will kill up to 35% of mosquitoes.

Index Terms: Adafruit cloud, Electric fence, Internet of Things, Mosquito trap, Mosquito Liquidator, Raspberry Pi, Ultra Violet ray, Ultrasonic wave.

I. INTRODUCTION

Delhi has announced its first dengue case this year in January despite the fact that the vector borne ailment is generally revealed among july and November. Last year i.e in 2018,2798 dengue cases and 4 deaths were recorded by south delhi municipal corporation, which tabulates the vector born diseases in the city. Since the Second World War, dengue

has turned into a worldwide issue and is regular in more than 110 nations. Consistently every year around 50 to 528 million individuals are contaminated and around 10 000 to 20 000 die .In December 2005, the outbreak of Chikungunya fever (CHIK) occurred in India. The isolated virus phylogenetic analysis showed a central - eastern African strain closely linked to the Reunion Islands strain. Historically, the first CHIK outbreak was reported in Kolkata in 1963.Zika virus was first isolated in 1947 in the Zika forest in Uganda, which is where it gets its name from. It is transmitted by the day-time Aedes Aegypti mosquitoes, which are also carriers of dengue. In Hyderabad Contrary to the usual trend of the dengue season coming to an end in the month of October, this year the virus has become more active with 477 new cases being reported over the last fortnight. After Swine Flu fear, it's the dengue fever that has kick-started with whopping numbers. There are 110 cases in just a week. Eight cases of chikungunya were reported in the September, taking this year's total to 97. About 38 malaria cases were recorded in the September.

II. RELATED WORK

Ayankumar describes a novel mosquito trapping system by employing the advantage of fibre optic sensor and provides the efficient mosquito detection system with less power consumption [1]. The KOM Project is exploring how to build reasonable and supportable without mosquito zones, in intestinal sickness endemic sub-Saharan Africa and somewhere else. Mosquitoes are vectors for a few sicknesses intestinal sickness, Chikungunya, dengue fever, lymphatic filariasis (elephantiasis), Ross River fever, West Nile infection malady and yellow fever. Detaching mosquitoes from hosts additionally breaks sickness transmission. In outline, KOMKOM: Keep out Mosquitoes = Keep out Malaria KIMKIM: Keep in Mosquitoes = Keep in Malaria along these lines, one needs to re-engineer homes as bio-zones on the scene scale [O (1) mile]: without mosquito zones (MFZ), KOM walled in areas; Mosquito-containments regulation zones (MCZ), KIM enclaves. A KOM (KIM) nook is a mosquito-impervious divider encompassing a territory, sent for all time or occasionally in a provincial or urban setting. The obstruction is increased with a conveyance of BTK (goat trap-murder) units. Mosquitoes would then be able to be exposed to crowding, decimation or entomological evaluations. At present, the Project is in the idea advancement organizing, and is indicating and prototyping subsystems: KOM (KIM) dividers, borders: skirts and collars; BTK units; airtight chamber innovation for passage leave ways; and robotizing vector demolition. The Companion MedizDroids Project is looking into UAVs, rambles and multi-copters as mosquito control rambles for vector control, that can misused to wipe out mosquitoes from KOM (KIM) zones [2].

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Most of the current mosquito prevention and treatment of the general population use of mosquito nets, mosquito swatter, mosquito lamp and other tools, this study use the Solar-Powered Outdoor UV LED Mosquito Trapping System. In addition to the use of reflective optics to expand the range of physical trapping mosquitoes and designed to prevent mosquito escape fan, Furthermore, we used a photo catalyst coating (titanium dioxide) on the mosquito trap to increase the CO₂ concentration to simulate the human living environment and increase the effectiveness of mosquito trapping. Although, in recent years, temperature, airflow and carbon dioxide concentrations have been developed to attract mosquitoes, related products have been lacking in systematic quantitative analysis and because of the location of the power supply, the location of the placement has been limited. Therefore, the research works using the physical properties of the inducing factor, in a simpler and lower cost to capture the effect of capturing more mosquitoes, is conducive to the public use. The inclusion of light, colour and photo catalyst at specific wavelengths to enhance the attractiveness of dengue vector mosquitoes and supplemented by solar powered systems can also be used to improve field-based mosquito traps in the future. The purpose of this study is to expand the range of mosquitoes trapping and to further find ways to more effectively capture mosquitoes [3]. Mosquitoes go about as a vector for a large portion of the perilous ailments like intestinal sickness, yellow fever, dengue fever, chikungunya fever, filariasis, encephalitis, West Nile Virus contamination, and so forth. It is assessed that more than 700 million individuals become sick every year from mosquito transmitted illness and 3 million individuals die from intestinal sickness, including one kid every 30 seconds. Accordingly, various measures have been utilized to shield individuals from mosquitoes, for example, compound, organic, natural and individual security. At present accessible anti-agents are either manufactured synthetics like Ethylehexanediol (EHD), ethyl-3 (N-butylacetamidp) propionate (IR3535) or N, N-diethyl-m-toluamide (DEET), or plant inferred synthetics, for example, Citronella, eucalyptus & lemongrass. The bad mark of utilizing plant based anti-agents is that a large number of them are comprised of moderately unpredictable constituents and are commonly not powerful over extensive stretches of time. The best-known concoction creepy crawly repellent is N, N-diethyl-3-methylbenzamide (DEET). The viability of DEET giving a dependable insurance of as long as 8 hours from time of use against many blood sustaining bugs has been recorded in a few examinations. In the present examination, Bite-Free an indigenously created mosquito repellent cream, in which dynamic fixing is DEET (25% w/w) was assessed for its adequacy under controlled research facility conditions, utilizing arm in enclosure technique, in light of a WHO institutionalized methodology against three noteworthy malady vectors: Anopheles, Culex and Aedes mosquitoes, in correlation of its good, economically accessible mosquito anti-agents, "A". The examination was led at Center of Excellence in Science and Technologies (CESAT), Islamabad-Pakistan from June, 2013 to June, 2016. Mosquito provinces were raised in Insectory and kept up at 27 – 32 °C and 60% - 70% relative mugginess. Every single gathered mosquito was morphologically recognized by utilizing the key ZOOTAXA-589 (2004) under stereomicroscope model No.1106. Roughly 200 grown-up mosquitoes matured 7 to 10 days old were utilized in this

preliminary. Prior to the start of study, educated assent was gotten from all volunteers. Amid the preliminary all volunteers were observed for conceivable reactions of the anti-agents. A therapeutic specialist was close by amid the preliminaries to react to any symptoms. Defensive Efficacy of Bite Free was discovered 91.5% and security time was 6 - 7 hours and no any symptom was seen amid preliminaries. While Protective Efficacy of financially accessible mosquito repellent reference salve "A" was 86.4% & protection time was 6 - 7 hours. Bothering and redness of skin were noted in few subjects. Time span of usability of Bite Free was 03 years and reference cream "A" timeframe of realistic usability was discovered one year [4]. Illnesses which are transmitted by vector mosquitoes are significant medical issues in numerous nations. Although numerous mathematical models for infections had been defined, they are altered. As these sicknesses are spread by a typical vector, likenesses in the illness transmission are eminent henceforth it will be gainful to build a general model which envelops the study of disease transmission angles and transmission of mosquito-borne ailments. In this paper, a SI (Susceptible-Infectious) nonexclusive model for mosquito borne illnesses is defined. The model is involved partial differential reaction scattering conditions which intertwine both the human and mosquito peoples. Numerical recreation of this model is shown [5].

Simarjit[6] portrays about numerous illness brought about by Mosquitoes and different creepy crawlies which are hurtful for people. Additionally, proposed a mosquito repeller machine without utilizing substance which cause skin sickness for people, rather brilliant ultrasonic bug repulsing framework was proposed as they can cause numerous illnesses which are destructive for human wellbeing. So as to maintain a strategic distance from the mosquitoes, individuals utilize substance anti-agents which influence the earth unfavorably or mosquito repeller skin creams can make skin issues. This paper proposes the brilliant ultrasonic creepy crawly repulsing framework driven by gathering vitality from solar panels. The ultrasonic waves have frequencies in excess of 20,000 Hz which are quiet to people yet when bugs come in the contact with ultrasonic waves, they sense the waves from uncommon hair or sensilla present on the receiving wires of mosquitoes which will make weight on the sensory system and jam their own ultrasonic recurrence and power them to leave that territory. The recurrence scopes of 38-44 kHz can be utilized viably to repulse the mosquitoes and flies. The framework utilizes solar panel as vitality source to charge the battery-powered 12V battery which is utilized to drive the Arduino UNO to kill on and turn the mosquito repeller framework. The proposed brilliant mosquito repeller framework can be utilized to repulse mosquitoes from inside the region of 125 square meters. [6].

III. TRADITIONAL MOSQUITO TRAPPING SYSTEM

A mosquito swatter, generally made of a thicker metal or plastic than a standard fly swatter, is mounted on the finish of a springy wire. This drastically builds your odds of hitting a stationary mosquito by expanding the force of the swat.

In case you're dozing in a mosquito-pervaded territory, get a mosquito net to wrap around the bed or tangle so it contacts the floor on all sides. We have various methods to kill the mosquitoes in the existing system like repellent sprays, mosquito traps, mosquito killer bats etc. There are many drawbacks for these kind of methods. Due to illiteracy of some people, Skin reactions significantly occur by using low standard products and excessive use of repellents. But there is no system to trap and kill the mosquitoes automatically.

IV. PROPOSED IOT BASED SMART MOSQUITO KILLING SYSTEM

The above stated problems are rectified in the new proposed system. The major advantage of this system is that it can be operated over the internet. This system can also be set to turn on and off at a particular time frame. This system uses three different methods to kill mosquitoes. This is done by using a ultrasonic sensor, UV light and electric fence, DC fan and a mosquito liquidator. All the data of the devices operation can be tracked by the terminal in the raspberry pi using Internet of Things (IoT) technology. The developed device consist of 4 units which are as follows i) ultrasonic frequency generation unit ii) UV light and electric fence iii)DC fan iv) liquidator mosquito.

The devices used in this system would essentially be the same as the once used in our day to day life with a couple of different components like the ultrasonic frequency generator and DC fan. The ultrasonic frequency generator used produces short and high frequency pulses at different time intervals. These time intervals can be set by the user based on the requirement by modifying the code. The DC fan is used as mosquito trap to pull the mosquitoes into the electric fence. The UV light is placed behind the electric fence to attract the mosquitoes. When the mosquitoes come into contact with the electric fence, they get zapped.

In this proposed framework, the ultrasonic sensor is to be used to repel the mosquitoes from an area. The component used here is HC-SR04. This sensor is a very cost effective way of producing ultrasonic waves. It directly produces pulses in range of 40 KHz. The sensor produces 8 pulses in the span of 10us. This sensor is generally used to measure the distance between two objects based on Doppler Effect, but here it can be used for the generation of ultrasonic waves. The operating voltage of the sensor is only 5V, so it does not need any additional power supply and can draw its power directly from the raspberry pi.

This ultrasonic frequency repels the mosquitoes. A high frequency in the order of 40 KHz is generated. This frequency only affects the mosquitoes since any frequency above 20 KHz is inaudible to the human ears. UV light and electric fence is one of the most effective way of killing mosquitoes. This is normally observed in our day to day life in places like restaurants, mess halls and kitchens. But unlike the ones, seen in our day to day life the UV light electric fence in this device can be operated over the internet. This makes the device more effective. Research shows that the mosquitoes are attracted to UV light in the wavelength range of 365 to 395nm [10]. The UV light module used here is NTE 30128. This emits a UV light of frequency 390nm which is precisely what is needed. So, here UV light is used to attract the mosquitoes and a high voltage electric fence to zap the

mosquitoes. The raspberry pi is connected to the relay which is used to toggle this unit.

Mosquito traps are one of the best ways of capturing mosquitoes without killing. Any device which has a suction effect and doesn't let a mosquito escape can be used as a trapping device here a 12V DC fan is used as a mosquito trap. The fan rotates at high speeds at the range of 2100 to 3300 RMP. When the mosquito is in the range of the fan it sucks the mosquito, thus creating a mosquito trap. This mosquito trap is place in front of the UV light and electric fence. The mosquitoes are attracted to the UV light and when they are in the range of the, they get zapped in the electric fence. Since a raspberry pi is used which is connected to the internet it can selectively toggle the unit that can kill the mosquito in the trap. All the units are interfaced with raspberry pi. Raspberry pi 3 has an in-built IEEE 802.11ac Wi-Fi module as shown in Fig.1. Using this, the device can be operated wirelessly over cloud. It can also be set to automatically turn on and off at a particular time. This is the biggest advantage when compared to other devices of the same kind which have manual operation. In our proposed system, adafruit cloud is used to connect the device to the internet. The adafruit cloud is an open software and is very easy to setup. The adafruit cloud used to control the device can be accessed from anywhere since it uses minimum data and can work on a mobile data connection. All the history of the devices operation can viewed in the terminal of the raspberry pi and the current status of the device can be viewed in the dashboard section of the adafruit cloud. Thus the user gets all the information of the devices operation and also he can operate it remotely from anywhere.

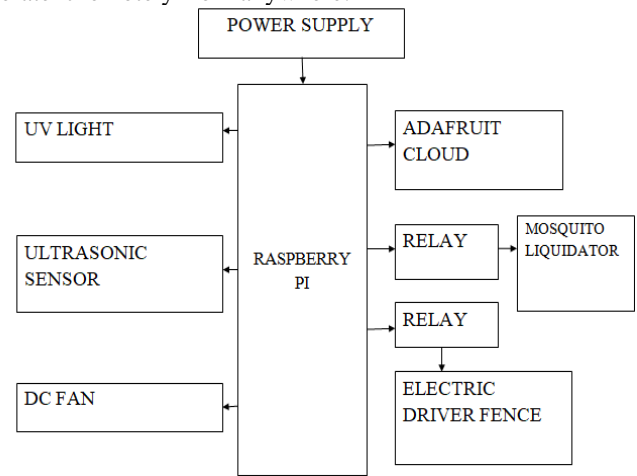


Fig. 1: Proposed IoT based Mosquito Killing System.

V. RESULTS AND DISCUSSION

The proposed system is made of using ultrasonic frequency generator, UV light and electric fence, mosquito liquidator and a 12V DC fan used as a trap. All these units are connected to the raspberry pi which is in turn connected to the adafruit cloud over Wi-Fi. The adafruit cloud displays the status of all the units and can also control them. Also, this information can be viewed in the terminal of the raspberry pi. The system is implemented in the following way.



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- Mosquito liquidator
- UV light and electric fence
- Ultrasonic frequency generator
- Mosquito trap
- Adafruit cloud

Fig.2 below shows the mosquito trap placed in front of the electric fence by using 12 V DC fan. This mosquito trap is used to suck the mosquitoes and not let the escape. Since the fan rotates with a high speed the mosquito cannot escape from the trap.



Fig. 2 DC Fan

Here the Fig. 3 shows the electric fence and UV light which attracts the mosquitoes and zaps them is shown. The UV light led NTE 30128 has a frequency of 360-390nm which attracts the mosquitoes and the fence is placed in such a way that to reach the light the mosquito has to go through the fence which zaps the mosquitoes.

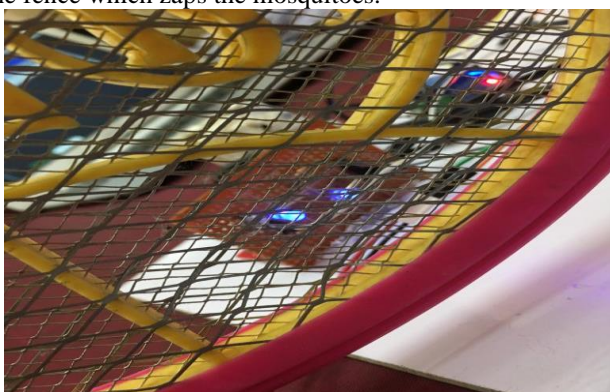


Fig. 3 Fig 5.2 Electric fence with driver

The ultrasonic sensor is shown in the below Fig.4. This ultrasonic frequency repels the mosquitoes. A high frequency in the order of 40 KHz is generated. This frequency only effects the mosquitoes since any frequency above 20 KHz is inaudible to the human ears. The operating voltage of the sensor is 5V only, it doesn't need any additional power supply and can draw its power directly from raspberry pi.



Fig. 4 Ultrasonic Sensor

Fig 5 shows that all the units such as UV Light, Ultrasonic sensor, 12V DC Fan, Electric fence with driver, Mosquito Liquidator are interfaced with raspberry pi 3. Here relay is used for switching on and off DC fan, mosquito liquidator and electric fence.

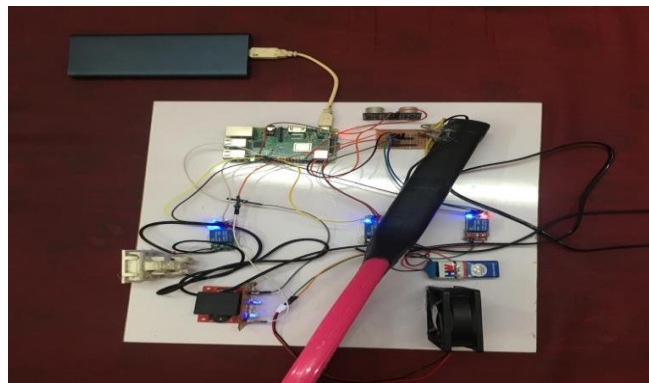


Fig. 5 Smart mosquito killing system

Fig.6 shows about the dashboard of the adafruit cloud. Adafruit cloud is used to connect the internet to raspberry pi 3. In this project, it is used to operate the device in remotely. Any number of switches can be added to this dashboard. Here we have five switches and it shows the real time status of the device.

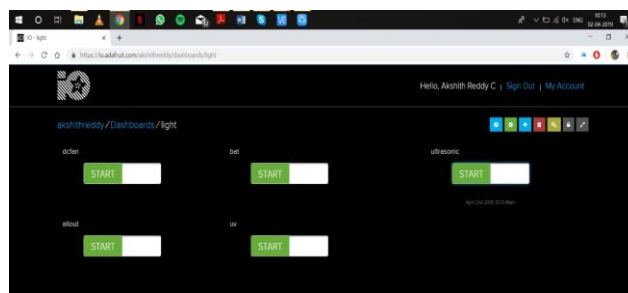


Fig. 6 Adafruit Cloud

VI. CONCLUSION AND FUTURE WORK

Proposed method is used to reduce the population of mosquitoes by trapping and killing them is been demonstrated. Here, in this system UV Light, ultrasonic sensor and electric fence with driver are used to kill the mosquito which makes the system more efficient. It is connected to the raspberry pi 3 to the internet using adafruit cloud. Using that, the system can be controlled by switching it on and off. In this, it can be set to a particular time to switch on and off the device automatically. A new system for killing mosquitoes is developed to tackle the issues present in the current systems used in our day to day life. This system would help avoid the spreading of diseases like malaria and keep everyone healthier. Future work into this system could include a better trap for mosquitoes which will be able to selectively toggle other units if any mosquito is trapped. In light of the fact that mosquitoes spread diseases, this system can help the user to avoid mosquito bites while medicines and vaccines are being developed to prevent diseases.

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Dr. P. Vijayakumar is currently working as Associate Professor in School of Electronics Engineering at VIT university Chennai campus, India and completed his Ph.D in Wireless Security at Pondicherry University during 2015. He has totally 12 years of teaching and research experience and published more than 40 research papers in SCOPUS /SCI Indexed National / International Journals and Conferences. His area of specialization is Elliptic and

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