Heat Stroke Prevention Wearable Based in Internet of Things (IOT)

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Abstract - This study is to introduce the development of a new alerting system for parents about children exposure to risk related to heat stroke. The smart heat stroke detector was created with the intention of measuring the internal temperature of the human body, which is closely linked to cases of heat stroke. Heat stroke is caused by the body overheating, which usually occurs as a result of being exposed to or exerting physical effort in high temperatures. Usually, the foremost genuine of warm damage and warm stroke and can happen in case the body temperature rises to 40 °C (104 F) or higher. The methodology adopted for this sub project is implementing the Internet of Things (IoT) system and embedding the interface hardware into smartphone system software. This device connects to the network provider to display information the device gathers from the environment through sensors. A gateway enables cloud services to be accessed by devices that are not directly linked to the Internet. The results obtained undeniably implicit that the body temperature increased significantly when children too expose to the environment. Thus, the importance of this device evaluated through lecturers, parents and students perspectives was 90% respectively. The resulting system was also low in power and cost, non - invasive, and provided real time monitoring. It is also easy to use and provides accurate measurements. In conclusion, the study of this proposal will assist in the reduction of heatstroke among potential children in the near future in Malaysia.

Keywords: Heat Stroke Detector, Internet of Things, smartphone, temperature

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INTRODUCTION

Heatstroke may be a condition caused by your body overheating, as a rule as a result of drawn out presentation or physical effort to high temperatures. This most serious form of heat injury, heatstroke, can occur if your body temperature rises to 40 °C (104 F) or higher. Heatstroke need immediate medical attention. Untreated heatstroke can rapidly harm your brain, heart, kidneys, and muscles. The damage decreases as treatment is delayed, increasing the risk of real complications or death. Side effects of a hot flash include high body temperature, mental status, or changed behavior. Heatstroke can cause confusion, agitation, slurred speech, irritability, delirium, seizures, and coma. Sweating pattern changes. The skin will feel hot and dry to the touch in heatstroke caused by hot weather. Heatstroke caused by hard activity, on the other hand, might cause skin to feel dry or slightly damp. One of the symptoms is nausea and vomiting. That person may feel sick to stomach. Heart rate and breathing rate also increases. Cases of heat stroke spike at the end of June into July each year and continue through August. Director of Pediatric Sports Medicine, Troy Smurwa at the Children's Health Andrews Institute for Orthopaedics and Sports Medicine, says that heat stroke in children can be extremely serious. The Health Ministry recorded 14 heat-related illnesses from March 1 until today due to the recent heat wave phenomenon. Health Minister Datuk Seri Dr S. Subramaniam, 2016 said the cases comprised 11 heat exhaustion and 3 heat stroke cases. This study examined the medical records of three children who were entrapped inside

cars and analyzes their outcomes following the accidents. Following the accidents, the children got heat stroke and survived a coma for many days, but with serious cognitive damage. Two of the children were diagnosed with hyperactivity and attention deficit disorder, while the third was diagnosed with active epilepsy. Heat stroke caused by vehicular entrapment is one of the most avoidable brain injuries in children. Every year, a number of children are entrapped in cars or other vehicles, leaving survivors with substantial brain injury.

RESEARCH RELATED WORK Heatstroke

Heatstroke is a medical emergency symbolize by a high body temperature, altered mental status and ,in classical heat stroke ,hot , dry flushes skinheat stroke could start to multi-organ damage with haemorrhage and necrosis in the lungs, heart ,liver, kidney, brain and gut (Subudhi et al., 2012). Heat stoke occurs when the core body temperature hike against a falling thermoregulatory system (Leon et al., 2010).

Thermoregulatory

Thermoregulatory homeostasis, while devotes to by multiple mechanisms, is basically controlled by the core temperature of the human body. The body must carry out automatic regulatory measures in order to maintain homeostasis, grant it to stay within the safe ranges of human temperature (Leon et al., 2010)

Heat stress

During exercise in the heat, the temperature gradient between the body core and the skin narrows, and for thermoregulatory purposes skin blood flow must therefore increase (Arifwidodo & Chandrasiri, 2020).

Effects of heat stroke

The body's surface temperature rises as a result of these processes. When this scenario persists for an extended period of time, sweating causes dehydration, which, when paired with blood retention at dilated peripheral blood arteries, causes blood volume to drop (Subudhi et al., 2012). The body's surface temperature rises as a result of activities. When this situation continues for a long time, the dehydration caused by sweating progresses and, when combined with blood being retained at the dilated peripheral blood vessels, blood volume decreases (Epstein & Yanovich, 2019).

Factors of heatstroke

Danger can exist, but it isn't necessary. Patients may feel a prodrome of debility, headache, coldness, lack of full control of physical motions, and nausea in the early stages of heat stroke. It can also cause chest pain, breathing difficulties, and abdominal pain. Thirst isn't a good predictor of severe heat stroke. The body's temperature rises quickly, perspiration stops, and several systems fail. The transition from warm depletion to warm stroke causes an acute stage inflammatory reaction. During heat stroke fever the temparature is increase 104°F equal to 40 °C or more. Sweating usually stops and the skin becomes heated and dry. Misfortune of awareness is followed by perplexity, incoherence, and ataxia. Seizures are common in some patients, and they usually happen when they cool down. Important symptom alterations include tachycardia and hyperventilation. An rise in haematocrit (a precursor to haemoconcentration), electrolyte and acid-base abnormalities (usually metabolic acidosis, hypokalaemia, and hyponatremia), and indications of muscle, kidney, and liver damage were discovered during a laboratory evaluation. Myocardial damage can be detected by an ECG and cardiac enzymes. If disseminated intravascular coagulation has occurred, thrombocytopenia can be severe (Epstein & Yanovich, 2019).

Heat stroke: classic and exertional

Classic heat stroke happens as a result of over the top natural temperatures, and basically influences individuals of helpless populaces, such as children or the elderly, those as of now in destitute wellbeing, or those who don't have the conditioning. Classic heat stroke is characterized by little or no sweating due to over dehydration (Grogan & Hopkins, 2002). Exertional heatstroke is caused by the generation of abundance warmth within the body and is more common among generally healthy people such as athletes and others who do an energetic activity out of doors. The capacity to sweat may not be impeded, but the individual is incapable to cool down rapidly sufficient after the ceasing of activities. This heat-related variation of sickness can happen quickly at moderately direct temperatures amid strenuous movement. (Fischer et al., 2012).

Benefits of heatstroke wrist band

The rising temperature on the earth's surface has had a substantial impact on human health in recent years, with the idea of heat stroke becoming a concerning problem, especially given the rise in deaths due by this illness. The impacts of high-temperature difficulties have piqued the interest of researchers, who believe that technology may play a key part in solving these challenges. The research illustrates the construction of a system that uses temperature sensors and the Internet of Things to identify heat stroke in children early. The findings suggest that the proposed approach is effective and feasible in real life.

Concept of Internet of Things

A recent study reported that Internet of Things links people, device and services[8].Furthermore, Internet of Things more likely to describe as a system or framework. Internet of Things known as connection between network of things or objects and Internet. Internet of Things consist of two words. That are Internet and Things. Internet depicts network that are linked world widely via some standard protocols. Moreover, The Things shows that any physical objects which has connectivity (Pawan, 2018; Waqas et al., 2017). Based on Cisco statistics nearly 50 billion devices will be communicated to the Internet by 2020 (Ryan, 2017). This turns IoT to become reality. The Internet of Things is gathering in importance with rising access to the Internet (Farooq et al., 2019).

Impact of Internet of Things

Internet of Things has a higher effect on certain sectors. That are education, business ,science ,communication ,humanity and government (Angelova et al., 2017). It also proven that this service helps the community by reducing costs , increasing efficiency and enhancing the usability of existing systems (Angelova et al., 2017). Some evidence proves that by using Internet of Things objects identify themselves and gain intelligence behaviour by allowing related decisions thinks to fact that they can communicate information about themselves. Market Analyst determined that IoT devices would reach 25 billion by 2020 (Pawan Singh, 2018). IoT devices will collecting a very big amount of data on the way people communicate between each other (Angelova et al., 2017).

Internet of Things Standardizations and Protocols

It was estimated that by 2020 around 50 to 100 billion things will be connected electronically to Internet (Zeinab Kamal Aldein Mohammad & Elmustafa Sayed Ali Ahmad, 2017). The Internet of Things' victory is based on standardisation, which ensures interoperability, compatibility, reliability, and efficient operations on a global scale, with more than 60 companies working with standards such as the IETF, IEEE, and ITU to define new IP-based technologies for the Internet of Things.

IoT and Health care Monitoring

Health care one of the biggest sectors in Internet of Things technology. IoT wearable device monitor patient health related blood pressure and body temperature (Saha et al., 2019). Health care sector uses smart health sensors to analyse and collect data using gateways and analyse through cloud and stores in clouds (Saha et al., 2019).

Cloud Computing

It was certified that cloud computing can analyse and stores data effectively. The cloud is the most convenient and cost-effective way to deal with IoT data, and it opens up new possibilities for data aggregation, integration, and exchange with third parties (Sadiku & Musa, 2014; Xian, 2017). Based on findings, Internet of Things platform need to be contributed by a powerful computing sources. Therefore, cloud computing is suitable for the development for Internet of Things platform.

Benefits of Using Internet of Things in Health Care System

In the health care and medical science, some of the main applications of the Internet of Things includes technological advancement in medical control of medications and equipment's, telemedicine and mobile health care along with personal medical management, health data management and etc (Malik et al., 2017). IoT could have various applications in medical industry for improving the quality of life, saving lives and reduce treatment cost. There are several benefits of using Internet of Things in Health Care System such as:

Reduction in Human Error

Data can be collected very accurately and precisely using various physiological medical sensor. It's can minimise human error in taken reading (Singh, 2018).

Early Detection of Chronic Disease

Using Big data analytics, it is possible to predict chronic disorder in early stage and treatment can be done within short period.

Obstacles without Alert System for Heat stroke

The effects of job stress are one of the reasons most people tend to forget (Ferrara et al., 2013). This clarifies that a person's daily life can affect their driving skills and contribute to their decision to leave their child alone in the vehicle due to stress and workload.

Visual Alert

Based on International Journal of Engineering and Computer Science in visual alert (Rubasri, Aravind, Valan, 2015). ODAS provides visual alert to the user by means blinking LED lights. Similar to audible alert, the frequency of blinking depends upon vehicle speed above threshold limit. But in our project research we are using Virtuino Software which is an Android app for monitoring sensors or control electrical devices via Bluetooth, local WiFi or Internet.

Working and ThingSpeak Setup.

ThingSpeak is an excellent tool for IoT-based Arduino projects. We can monitor our data over the Internet from

anywhere by utilising the Channels and websites supplied by ThingSpeak, and we can also operate our system over the Internet by using the Channels and webpages offered by ThingSpeak. ThingSpeak 'Collects' data from sensors, analyses and visualises it, and then 'Acts' by initiating a reaction.

Android App Based on IoT

Doctors and patients have distinct login passwords. Doctors may monitor the health state of all patients allocated to them, while patients can only check their own health condition by joining in with their own login credentials, and humidity status can be accessed by both doctors and patients using an Android app based on IoT in smart phones.
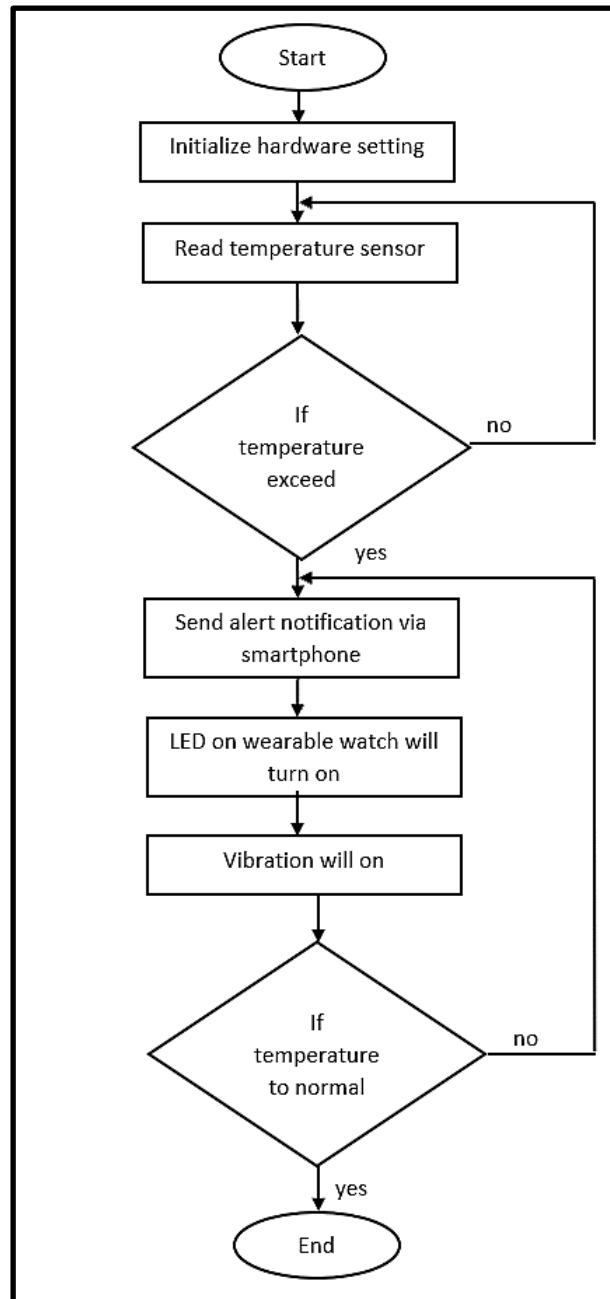
MATERIAL AND METHODS

Figure 1: Methodology

The methodology adopted for this sub project is by using smart phone and Apps .The app is based on IoT software. This software is going to be a connection between the wearable device and the application in smart phone. When the switch is ON, sensor will start measuring temperature in human body. If the voltage increases, then the temperature rises and there is a voltage drop between the transistor terminals of base and emitter, they are recorded by the sensor. If the temperature maintain on normal level, it will continue monitor the temperature. Once the temperature exceeds 38.5°C , a notification will be send to the parents smart phone using IoT. An LED will turn ON in the wearable watch by child if the temperature rise. Parents can monitor their child's body temperature in their Blynk Android App. **Blynk** is a new platform that allows you to quickly build interfaces for controlling and monitoring your hardware projects from your iOS and Android device. Once the parent press the alert button in the application, the vibration in the watch will stop. The device would keep on vibrating if the user(child) neglect to consume water. The reading of temperature will be shown on LCD display which help the user to read. If there is no changes in the temperature level, it will keep vibrating until action is taken. Once the temperature level come back to normal, LED and vibration will stop alarm.

RESULTS AND DISCUSSIONS
The research was carried out within predetermined period of time. It is necessary that each of the data found has a solution. Analysis of data will also show every study conducted either successfully achieve the objectives set out or not. Add on, a market survey conducted during the research was carried out. A survey was conducted in public areas such as supermarket, schools, and public areas. As a result of the analysis made, it is known that the resulting study is a success or failure. There are three questions will be asking to public:
1) Do you think heat stroke is ongoing problem among children?
2) Do you think we need to create a device to alert parents about the children internal temperature?
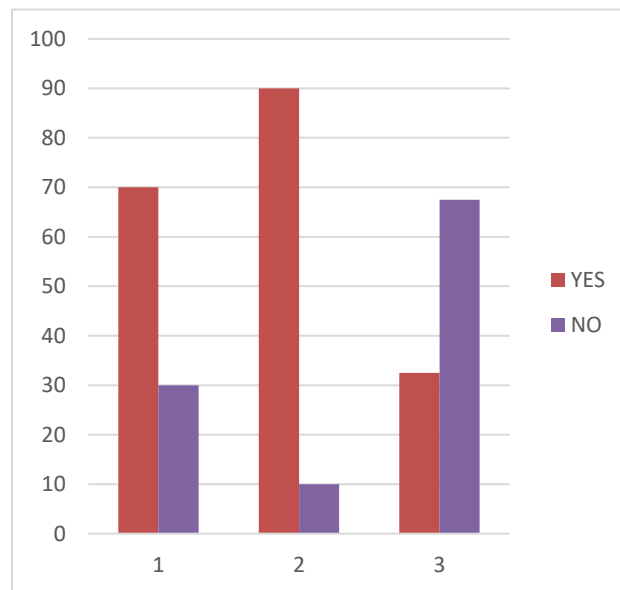3) Is there any IoT device that can monitor heat stroke temperature in the market?

Figure 2: Market Survery

From the Figure 2, majority of them aware that heat stroke is a on going problem on children. According to the Centers for Disease Control and Prevention, children are more vulnerable to heat-related diseases because they have less body surface area to control their temperatures. Younger children are more susceptible to heat exhaustion due to a lack of sweating space and a lack of regulating capability. Children are also unable to regulate their body temperature on their own. Humidity and thirst also play a part. When the humidity level in the surroundings is more than 60%, children have a tougher time cooling down since their sweating mechanism doesn't operate as effectively.
In addition, 90% of them agreed to create a device to alert parents about the children internal temperature. According to No Heatstroke.org, 760 children have died of heatstroke in cars since 1998. In over half of the cases, the child was left in the vehicle by accident. According to the website, nearly 74% of the deaths have been in children ages 2 and younger. More than half the time the child is forgotten by a caregiver. Most of the parents need a device to alert them regarding their children temperature. Furthermore, it will be easier for them to monitor the temperature. Hopefully this will prevent heat stroke cases in the future. Furthermore, 67.5% of them said there was no IoT gadget that could monitor

or warn the body temperature in the market. However, companion gadgets have greater potential, at least in terms of financial impact and return on investment, in business environments. Within healthcare there is worried about the encounters that clients do not have at the bedside, but also in waiting rooms, crisis rooms and commercial workplaces. Healthcare organizations are also at the forefront of IoT, with 55% of them having fairly strong agreements. In healthcare, audio gadgets and feature phones are the most used basic gadgets, according to 46% of respondents in the division. The majority, 57%, also employ visual analytics to improve their levels of customer service and patient care. Iot device will help to reduce number of heat stroke patients and will help parents to monitor children temperature using real time data.

CONCLUSION

From this project, it got to encourage the self-expression of thoughts and and feelings related with illness/hospitalization. And also, help patient process and work through traumatic experiences associated with hospitalization. Next to facility positive self-esteem and positive body image, and promote a sense of independence and feelings of control. Encourage the development of healthy strategies for coping with hospitalization. The main result of this project is to help to measure the temperature to prevent heatstroke among children. Most of the rehab process is depends on feeling of patient and judgement by doctor. Sometimes the judgement could be wrong. With this project it got to resolve this problem and give an accurate rehab level things to patient. The resulting system was also low in power and cost, non - invasive, and provided real time monitoring. It is also easy to use and provides accurate measurements.

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