

Smart Health Monitoring System for Pregnant Women - AMIE

College: St. Joseph Engineering College

Branch: Electronics and Communication Engineering

Name of project guide:	Mr. Glenson Toney Email: glensont@sjec.ac.in Contact No.: 9972187359
Name of Team Members:	Name: A SPOORTHI RAI USN : 4SO19EC001 Email id: aspoorthirai@gmail.com Mobile No: 9740609085
	Name: ISHIKA USN : 4SO19EC037 Email : ishikapoojary032@gmail.com Mobile No:8861948324
	Name: JENISHA MARIA DSOUZA USN :4SO19EC041 Email id : jenidza22@gmail.com Mobile No.:9567030502
	Name: JEETHESH DSOUZA USN: 4SO19EC040 Email : jeetheshdza@gmail.com Mobile No.:8722969072

INTRODUCTION

According to the facts given by WHO, “Every day in 2017, approximately 810 women died from preventable causes related to pregnancy and childbirth”. In developing countries like In India, the occurrence of maternal mortality rate is especially due to the unavailability of fully equipped hospitals and delayed reach to available facilities in rural areas. Nearly all maternal deaths occur in countries that are in growth (developing). A woman’s death is a consequence of complications in labor and pregnancy. Different complications could exist before pregnancy, but they are worsened throughout pregnancy, particularly if not managed as part of the woman’s care. The major complications that account for nearly 75% of all maternal deaths are due to severe bleeding, infections, complications from delivery etc. Other factors that prevent women from receiving or seeking care during pregnancy and childbirth are Poverty, distance, lack of information, inadequate services, and cultural practices. Throughout, most of these complications evolve and in pregnancy are treatable.

In many rural areas, there is a lack of knowledge and awareness that leads to high mortality among living women in rural areas. Regular check-ups will help to reduce the birth rate of abnormal children and the rate of fetal mortality. In rural areas, pregnant women are not much concerned about their health and don’t go for routine check-ups. They need to travel a lot due to the lack of proper hospitals and clinics in villages. A routine check-up is very important during pregnancy to identify the health status of the baby and the mother. IOT-based pregnant women caretaking system would greatly reduce the number of these needless deaths and enhance the lifestyle of pregnant women and allow them to live in rural areas where their hometown because IOT devices are attached to pregnant women and all the activities can be monitored by doctors from anywhere and anytime, so it gives the assurance of pregnant women safety. IoT provides a lot of opportunities to decide that pregnant women care about tagged pregnant women with system details. With the use of gynecologists, medical practitioners, specialists, nurses, and physicians act as a helping hand.

This system is very efficient and useful for real-time applications. The doctor from near the health care centre can monitor these values via smartphone and the mother also viewed by using the smartphone app. The risk in the later month can be predicted earlier. Because IOT devices are tied to pregnant women and their homes, an IOT-based system for caring for

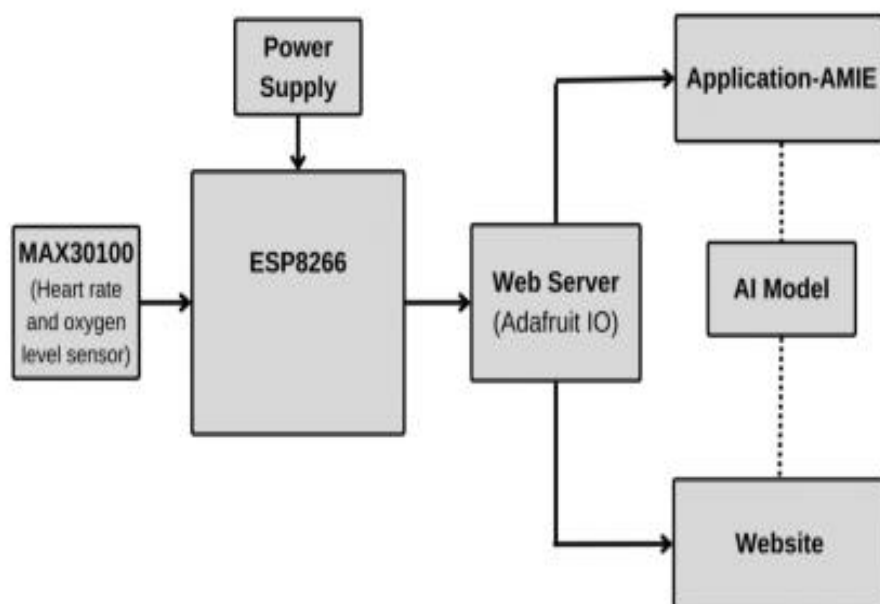
pregnant women will significantly lower the number of these unnecessary deaths, improve the lifestyle of pregnant women, and enable them to reside wherever they were raised.

Doctors can keep an eye on all actions from anywhere at any time, ensuring the safety of pregnant women. IoT offers many chances for deciding what pregnant women care about when they are tagged with system information using gynecologists, medical professionals, specialists, nurses, and doctors to provide assistance. Although we have attempted to include the majority of the significant, inescapable aspects that, when taken care of, can improve the condition, especially in rural locations where regular check-ups and tests are not available, this device can still be further improved by including other capabilities. Additionally, it would lessen the crowds at clinics and hospitals in urban areas because only a few women who have serious problems or who are recommended by doctors are allowed to enter.

OBJECTIVES

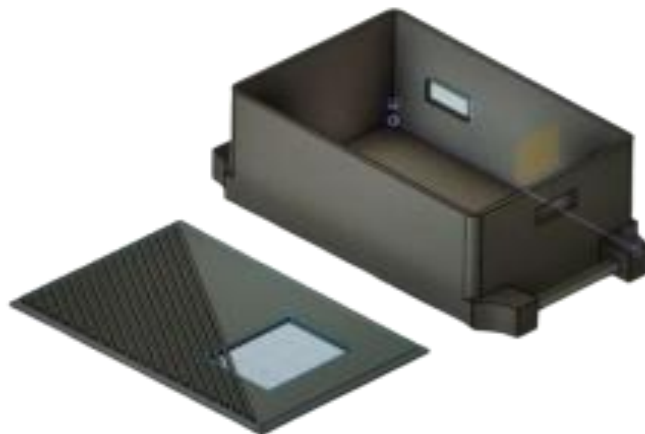
1. To conduct a thorough literature review to identify indicative parameters of pregnant women to be monitored.
2. To design and develop an IoT based health monitoring system for pregnant women.
3. To develop a mobile application to collect the vitals and also interact with the pregnant women as well as gynaecologists.
4. To develop an AI prediction model to predict risk at earlier stage.

METHODOLOGY



Data sources used in our implemented system includes an Integrated device, Cloud and a mobile application and background information. Integrated devices contain sensors like MAX30100 to measure heart rate and oxygen level. The IoT based monitoring system uses MAX30100 sensor to measure pulse rate and blood oxygen content. The sensor is wired, to collect data from the patient's body. The sensors are all connected to a processing unit known as the ESP8266. The collected data is processed by an Esp8266 module before being sent to the gateway server. The collected parameters or the data is stored in cloud which is Adafruit.io and sent to the mobile application where the data are then analysed to obtain various health-related parameters—such as stress, sleep and physical activity. The values are sent from the server to our application for further analysis. The mobile application displays health parameters such as blood pressure, oxygen level, and heart rate. It also collects background information and provides communication services for users to address any concerns regarding their health condition. The app is developed using Android Studio in the Java programming language. The collected data is sent to a web server where it is analysed and compared against the predefined algorithms. The Threshold parameters are obtained from the to create algorithms for the mobile app. The mother is required to input basic medical history

and other relevant information at the beginning. Parameters such as blood pressure and sugar levels need to be manually entered each time. The analysed values are then displayed within the application. If there is any deviation from the threshold values, the mother is provided with a tailored diet and exercise plan within the application, which she should follow to bring her vitals back to normal. In case of severe variations, notifications are sent to the mother, the doctor, and a family member. Both the mother and the doctor can access the app. Women experiencing stress can engage in one-on-one counselling with a counsellor and can also book regular check-up appointments with the gynaecologist through the website. A prediction model has been developed to identify the risk at an earlier stage based on the pregnant women's values.



The body of the Integrated device is being 3D Printed at AICTE SJEC IDEA Lab. The Design is done using fusion 360 and Creality Software is used to slice the model.

RESULT AND CONCLUSION

The Integrated device in Fig 4.1 shows the 3D printed model of smartwatch. The model is printed using PLA material and Design is done using fusion 360 and Creality Software. The model contains ESP8266 Microcontroller and MAX30100 ,a heart rate and oxygen level Sensor.



Fig.4.1: Integrated Device

The output data obtained from the MAX30100 sensor and ESP8266 microcontroller is sent to the Adafruit IO server. This server acts as a platform for storing, visualizing the collected data and also provides a convenient interface to view and manage the received data. Fig.4.2 shows interface of Adafruit IO Server.



Fig.4.2: Server

Fig 4.3 and 4.4 shows the interface of login and health status page. The analysed values are displayed in the application. Based on the current value, customized diet is provided in the application.

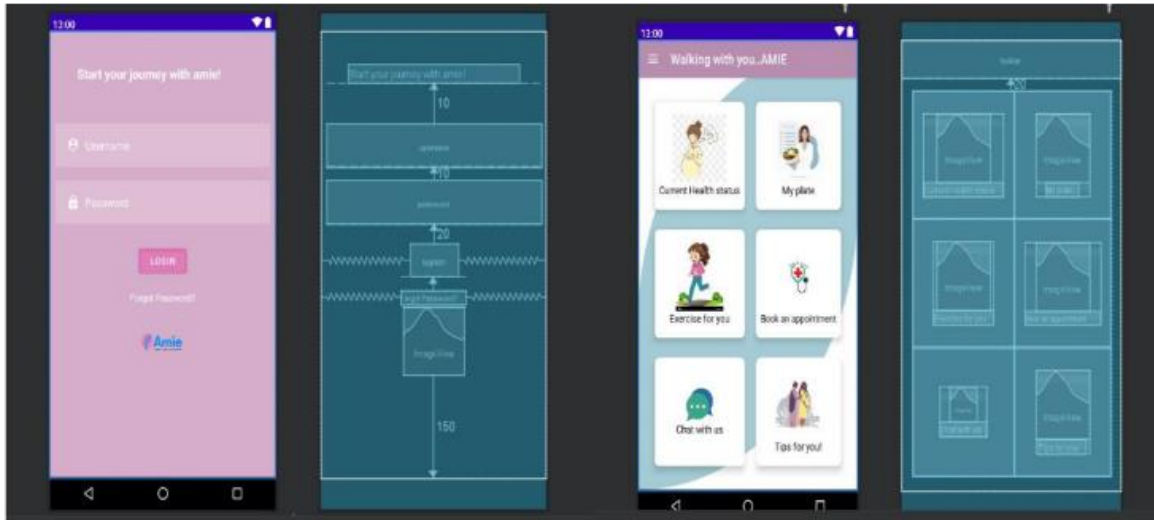


Fig 4.3: Login Page

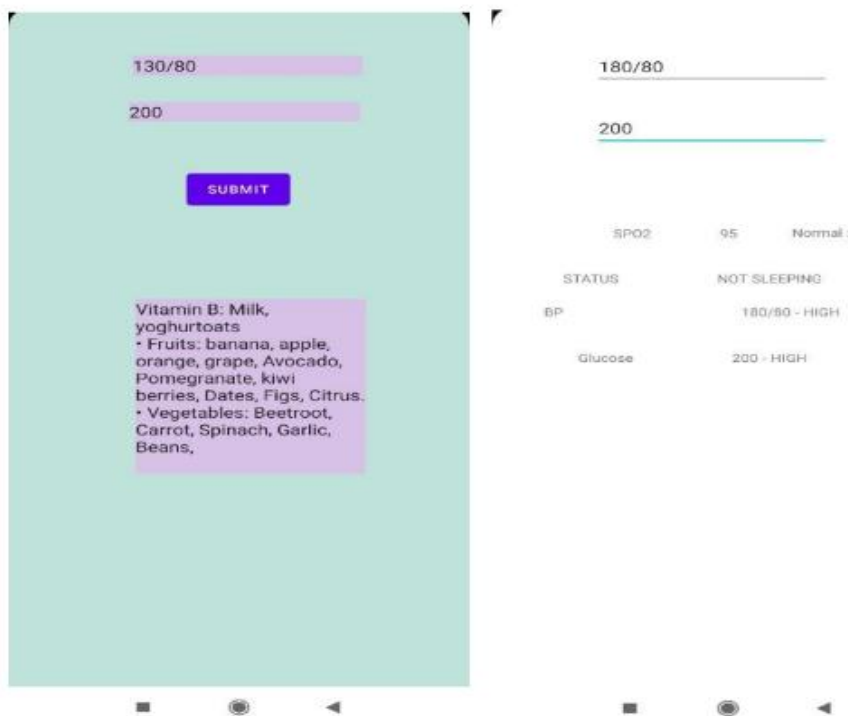


Fig 4.4: Health Status

Fig 4.5 shows exercise for the Pregnant women based on her value. Women under anykind of stress can have counselling and book an appointment through the Website. Also, Women will get Tips for her Healthier pregnancy.

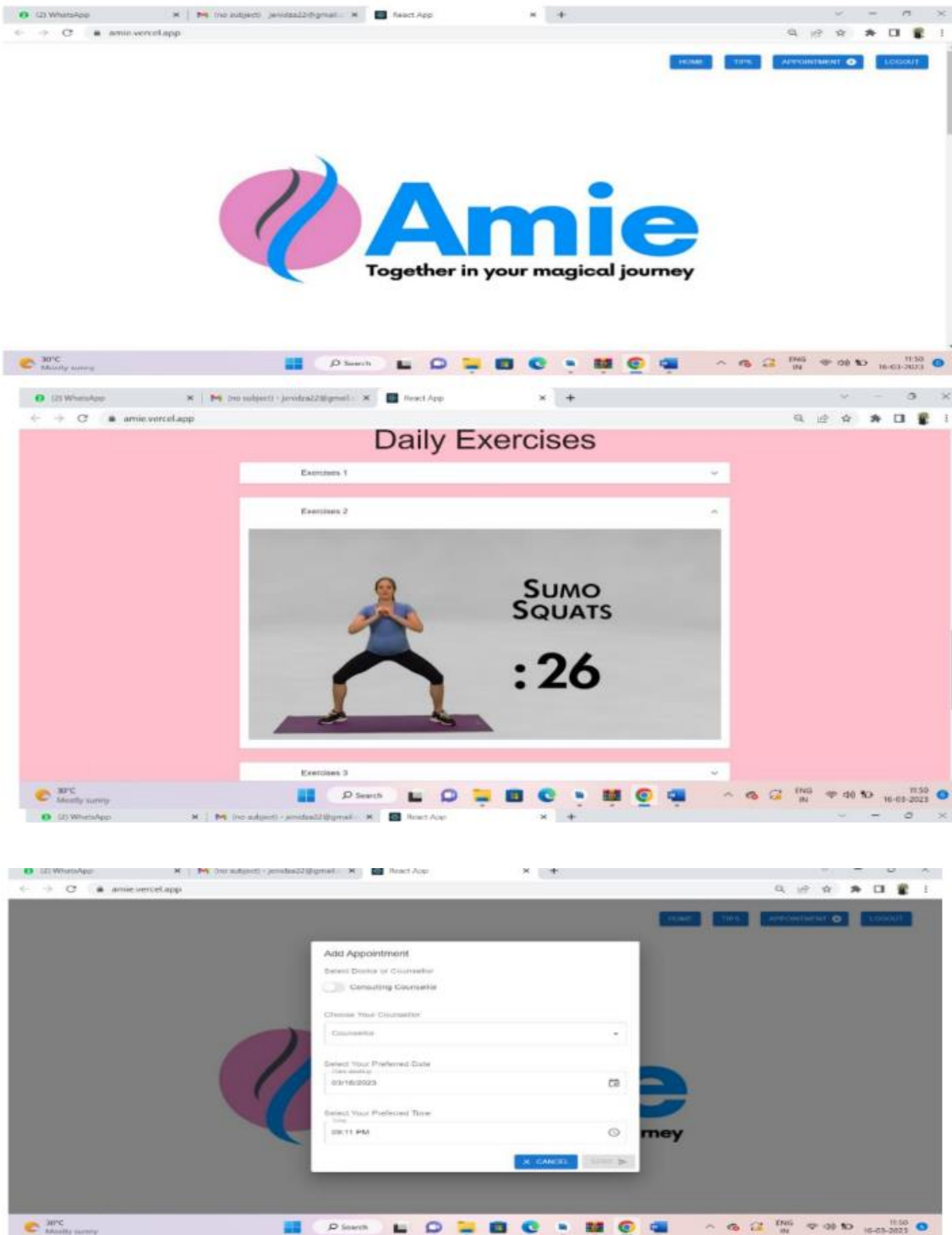


Fig.4.5: Website

Fig 4.6 shows the result of K Nearest Neighbor(KNN). We have used Kaggle Database and obtained the accuracy of 75% for this classifier.



Fig. 4.6: Prediction Model Result

Maternal health monitoring is important to ensure the health and well-being of the mother and her child, as many health complications occur during pregnancy with a lifetime effect on their health. In the literature, some studies exploited IoT-based systems for maternal monitoring, although they were limited to specific health problems, short-term data collection or self-report questionnaires. The ESP8266 and MAX30100 are electronic components commonly used in IoT and wearable devices. The ESP8266 is a Wi-Fi module that enables wireless communication, while the MAX30100 is a pulse oximeter and heart rate sensor. The real-time monitoring and customised treatment offered by the IoT-based pregnancy health monitoring system proved to be quite successful. Blood pressure, oxygen level, and heart rate were among the health metrics that the system effectively collected and analysed, enabling prompt identification of any deviations from normal ranges. It was obtained that the individualised food and activity offered by the application were helpful in assisting moms to regulate their vitals and maintain a healthy pregnancy.

CONCLUSION AND FUTURE SCOPE

Maternal mortality is estimated at greater than one-half million women per year during childbirth (about 1,440 per day) in India. These deaths are a consequence of complications in labor and pregnancy. Complications can include miscarriage, Gestational diabetes, Anaemia, Infections, Hypertension, Pre-Eclampsia. In many of the rural areas there is a lack of sufficient antenatal care, lack of medical facility and economic circumstances and lack of knowledge and awareness that leads to high mortality within living women in rural areas. This idea benefits medical aid of pregnant women mainly in rural area without manual intervention. Keeping in mind the main factors or parameters adversely affecting, accurate and precise result giving sensors are used. This device can be improved further by adding other features as well, but here we have tried to involve most of the important unavoidable parameters which when taken care of can improve the condition, especially in rural areas where regular check-up and test is not available or possible. During pregnancy and postpartum, it assists in monitoring of vital signs such as blood pressure, heart rate, oxygen level and sleep cycle. It provides tailored food plan and training schedule based on users' health status. The mobile application ensures that the connect with the consulting gynaecologists and counsellors are just a tip away. Also, in cities, it would reduce the crowd in clinics or hospitals as only selected ladies which have critical conditions or as per the record and doctor's advice come. Also, it would predict the risk at earlier stage. Hence, it would surely act as helping hand for pregnant women and the baby. It is just a step towards making health monitoring easier and better than the existing one in some way. Amie is a friend, walking together with mothers in their magical journey.

INNOVATION OF THE PROJECT

Amie is a friend in one's most magical journey to motherhood: pre and post. With families turning micro, many rely on information available on open source which may not be authentic. Amie steps in as a credible source of information and connects the users with approved medical practitioners who can transform their journey into motherhood to a beautiful experience. Amie monitors the health condition of the women constantly and delivers tailored lifestyle plans to ensure good health. Introducing a social innovation in the form of a smart health monitoring system for pregnant women. Along with the wearable biometric sensors and mobile application, this system incorporates remote monitoring and telemedicine capabilities. By integrating telemedicine, pregnant women can remotely connect with healthcare professionals for consultations and check-ups, ensuring access to quality prenatal care regardless of their location. This is especially beneficial for women in remote or underserved areas, as it eliminates the barriers of distance and transportation, saving time and expenses. Moreover, this innovation promotes inclusivity by providing support to pregnant women who may face challenges in accessing traditional healthcare facilities due to various reasons. By leveraging technology for remote monitoring and telemedicine, this social innovation enhances maternal healthcare accessibility and equity, improving outcomes for pregnant women regardless of their socioeconomic status. It empowers expectant mothers by putting their health in their own hands and connecting them with the necessary medical expertise, ultimately contributing to healthier pregnancies, early detection of complications, and improved maternal and fetal well-being. We also connect them virtually/physically with gynaecologists and counsellors on demand and automatically when the health condition demands. While ample products operate in the market towards pregnancy needs, most of them look at only a few factors and fail to provide an end-to-end tailored distinct plan. Also, Amie at our core believes in data confidentiality and is working towards ensuring privacy. We look at being a friend and that makes us a family, a partner in the journey.

SCOPE OF THE WORK

Maternal mortality is estimated at greater than one-half million women per year during childbirth (about 1,440 per day) in India. These deaths are a consequence of complications in labor and pregnancy. Complications can include miscarriage, Gestational diabetes, Anaemia, Infections, Hypertension, Pre-Eclampsia. In many of the rural areas there is a lack of sufficient antenatal care, lack of medical facility and economic circumstances and lack of knowledge and awareness that leads to high mortality within living women in rural areas. This idea benefits medical aid of pregnant women mainly in rural area without manual intervention. Keeping in mind the main factors or parameters adversely affecting, accurate and precise result giving sensors are used. This device can be improved further by adding other features as well, but here we have tried to involve most of the important unavoidable parameters which when taken care of can improve the condition, especially in rural areas where regular check-up and test is not available or possible. During pregnancy and postpartum, it assists in monitoring of vital signs such as blood pressure, heart rate, oxygen level and sleep cycle. It provides tailored food plan and training schedule based on users' health status. The mobile application ensures that the connect with the consulting gynecologists and counsellors are just a tip away. Also, in cities, it would reduce the crowd in clinics or hospitals as only selected ladies which have critical conditions or as per the record and doctor's advice come. Also, it would predict the risk at an earlier stage. Hence, it would surely act as a helping hand for pregnant women and the baby. It is just a step towards making health monitoring easier and better than the existing one in some way. Amie is a friend, walking together with mothers in their magical journey.